Sergey Kurdubov et al.: Antenna Axis Offset Estimation from VLBI, IVS 2010 General Meeting Proceedings, p.247–250
http://ivscc.gsfc.nasa.gov/publications/gm2010/kurdubov.pdf

Antenna Axis Offset Estimation from VLBI

Sergey Kurdubov, Elena Skurikhina

Institute of Applied Astronomy RAS
Contact author: Sergey Kurdubov, *e-mail:* `ksl@quasar.ipa.nw.ru`

Abstract

The antenna axis offsets were estimated from global solutions and single sessions. We have built a set of global solutions from R1 and R4 sessions and from the sets of sessions between SVETLOE repairs. We compared our estimates with local survey data for the stations of the QUASAR network. Svetloe station axis offset values have changed after repairs. For non-global networks, the axis offset value of a single station can significantly affect the EOP estimations.

1. Axis Offset Estimation

The main task of this study is to check the stability of the axis offset value after repairs. The axis offset estimations from single sessions are very unstable (see Fig. 1), therefore we use global solutions [3] over several time intervals. For the estimation of the SVETLOE axis offset we used the R1 and R4 sessions divided into four intervals:

- 2003.03.06-2005.05.26, 55 sessions, from start of operation until test rail repair
- 2005.07.21-2006.05.04, 40 sessions, from test rail repair until full rail repair and removing of large equipment cabin
- 2006.08.03-2007.06.21, 55 sessions, from full rail repair until repair of the bearings
- 2007.08.30-2009.06.25, 141 sessions, from bearings repair until now

1.1. Comparison of Our Results with the On-site Measurement Data

We have three on-site measurements of the SVETLOE axis offset: in 2005 and 2006 by Igor Shahnabiev and in 2009 by “Yustas Ltd”. Comparison of our estimated values (designated as “VLBI”) and on-site Local Geodetic Surveying measurement (designated as “On-site”) are presented in Table 1.

Table 1. Values of SVETLOE axis offset from VLBI and on-site measurement (in mm).

	2003.03.06-2005.05.26	2005.07.21-2006.05.04	2006.08.03-2007.06.21	2007.08.30-2009.06.25
VLBI	-15.5 ± 3.2	-15.9 ± 3.6	-10.0 ± 2.8	$+1 \pm 2$
On-site	$-12.5\pm??$		-7.5 ± 0.5	-3.0 ± 1.5

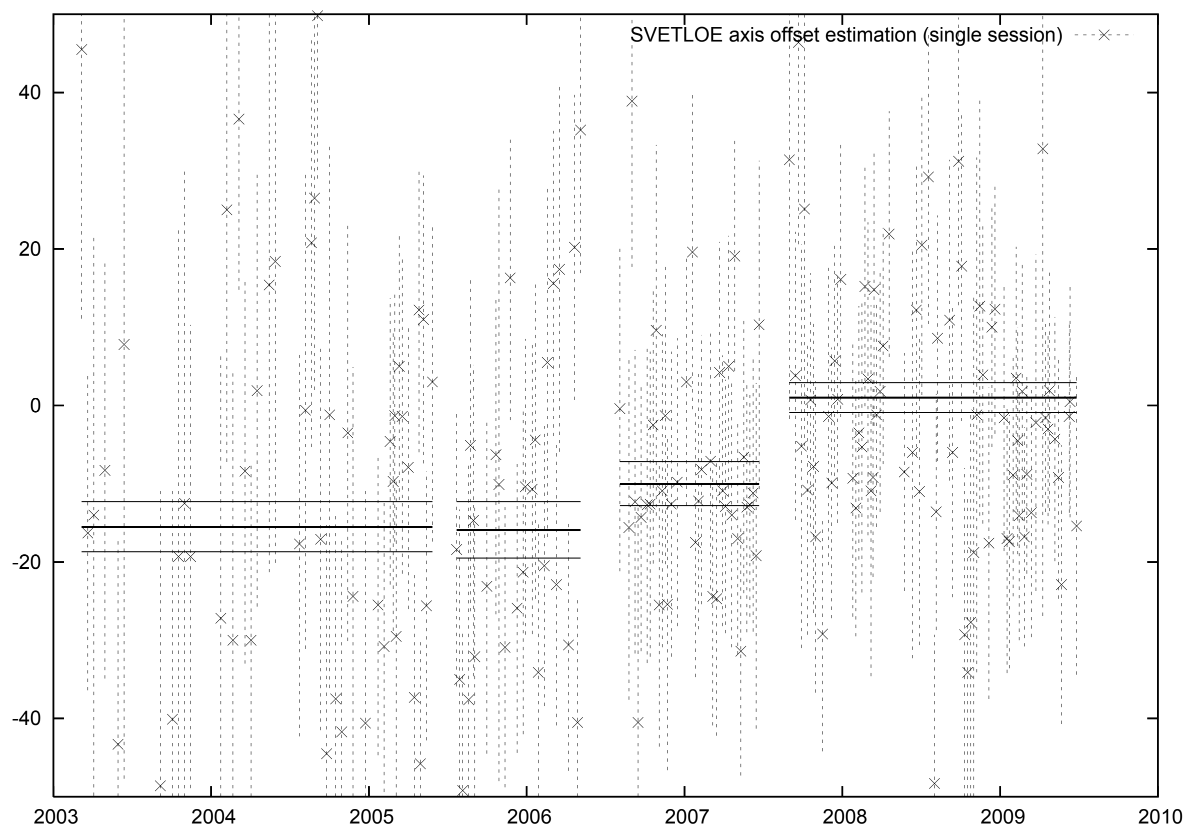

Figure 1. Estimated SVETLOE axis offset from single sessions (crosses) and four global solutions (black solid lines), in mm. The dashed lines indicate error bars.

1.2. Influence of Axis Offset on Estimation of EOP from Local Network

In order to determine how the difference in axis offset can affect our EOP estimations from local network observations, we have processed 41 sessions of our domestic Ru-E [2] program. Ru-E observes 24-hour sessions with Network "Quasar" [1] with the three observatories Svetloe, Zelenchukskaya, and Badary scheduled for the EOP estimation. The biases and RMS (after removing bias) between obtained EOP and IERS 05 C04 series are presented in Tables 2–6. For the results presented in Tables 2–4 the single value of SVETLOE axis offset was used for all sessions. For the results in Table 5 and Table 6 the estimated and measured values were taken for corresponding time intervals.

One can see from a comparison of Table 3 and Table 4 that a difference of 1 cm in axis offset can give a difference up to 0.5 mas in the Y-pole coordinate for our network configuration. The differences in axis offset did not have much impact on the RMS, but it can introduce systematic biases in EOP.

1.3. Conclusion

The value of antenna axis offset can significantly affect parameters estimated from VLBI data processing. Offsets may change after repair work at a station. In order to improve the accuracy of VLBI results it is necessary to estimate the axis offset after a station repair by on-site measurement or from reprocessing of observations. The differences between estimated and measured values need to be investigated.

Table 2. Biases and RMS vs. IERS EOP 05 C04 of EOP estimations with SVETLOE offset = -7.5 mm.

	bias	rms
Xp, mas	-0.114 ± 0.165	0.952
Yp, mas	0.588 ± 0.212	1.225
UT, ms	0.009 ± 0.008	0.046
Xc, mas	-0.608 ± 0.120	0.695
Yc, mas	-0.093 ± 0.114	0.660

Table 3. Biases and RMS vs IERS EOP 05 C04 of EOP estimations with SVETLOE offset = -3 mm

	bias	rms
Xp, mas	-0.109 ± 0.166	0.959
Yp, mas	0.790 ± 0.211	1.221
UT, ms	0.005 ± 0.008	0.046
Xc, mas	-0.596 ± 0.118	0.684
Yc, mas	-0.094 ± 0.113	0.652

Table 4. Biases and RMS vs IERS EOP 05 C04 of EOP estimations with SVETLOE offset = -12.5 mm

	bias	rms
Xp, mas	-0.101 ± 0.157	0.908
Yp, mas	0.342 ± 0.210	1.216
UT, ms	0.012 ± 0.008	0.046
Xc, mas	-0.619 ± 0.118	0.679
Yc, mas	-0.104 ± 0.109	0.631

Table 5. Biases and RMS vs IERS EOP 05 C04 of EOP estimations with estimated SVETLOE offsets = -16 mm, -10 mm, 1 mm for corresponding intervals

	bias	rms
Xp, mas	-0.111±0.161	0.956
Yp, mas	0.690 ±0.210	1.213
UT, ms	0.006±0.008	0.046
Xc, mas	-0.615±0.116	0.667
Yc, mas	-0.087±0.111	0.641

Table 6. Bias and WRMS vs IERS EOP 05 C04 of EOP estimations with measured SVETLOE offsets = -12.5 mm, -7.5 mm, -3 mm for corresponding intervals.

	bias	rms
Xp, mas	-0.090 ± 0.161	0.932
Yp, mas	0.590 ± 0.210	1.210
UT, ms	0.008 ± 0.008	0.046
Xc, mas	-0.602 ± 0.120	0.693
Yc, mas	-0.110 ± 0.115	0.644

References

[1] A. Finkelstein, A. Ipatov, S. Smolentsev. The Network “Quasar”: 2008–2011. Measuring the Future, Proceedings of the Fifth IVS General Meeting, ed. A. Finkelstein, D. Behrend, St-Petersburg, “Nauka”, pp. 39–46, 2008.

[2] A. Finkelstein, E. Skurikhina, I. Surkis, A. Ipatov, I. Rahimov, S. Smolentsev. QUASAR National Programs of EOP Determinations. Measuring the future Proceedings of the Fifth IVS General Meeting, ed. A. Finkelstein, D. Behrend, St-Petersburg, “Nauka”, pp. 319–323, 2008.

[3] S. Kurdubov. QUASAR software in IAA EOP service: Global Solution and Daily SINEX. Proceedings of the 18th European VLBI for Geodesy and Astrometry Working Meeting, ed. by Johannes Boehm, Andrea Pany, and Harald Schuh, GEOWISSENSCHAFTLICHE MITTEILUNGEN, Heft Nr.79, pp. 79–82, 2007.