INFLUENCE OF DIFFERENT STRATEGIES IN VLBI DATA ANALYSIS ON REALIZATIONS OF ICRF

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Session 1: Plans for the new ICRF

Introduction

A realization of Celestial Reference Frame is obtained from VLBI data analysis. This realization depends on applied models of geophysical phenomena and strategy in data analysis.

This talk presents preliminary results on how selected models are distorting obtained coordinates of radio sources. The work is similar to the one presented in Tesmer (2007) and other papers.

A comparison between a reference catalogue and a tested one was performed with a LS estimation of the rotation and deformation parameters:

$$\Delta\alpha = A_1 \tan\delta \cos\alpha + A_2 \tan\delta \sin\alpha - A_3 + D_\alpha(\delta - \delta_0) + C_\alpha \sin(\alpha + \varphi_\alpha)$$
$$\Delta\delta = -A_1 \sin\alpha + A_2 \cos\alpha + D_\delta(\delta - \delta_0) + B_\delta + C_\delta \sin(\alpha + \varphi_\delta)$$

VLBI Data Analysis

VLBI data:

- From 1984 till June 2007
- 709 radio sources, 75 stations

Models:

- IERS Conventions (2003)
- Atmospheric pressure loading, Petrov and Boy (2003)

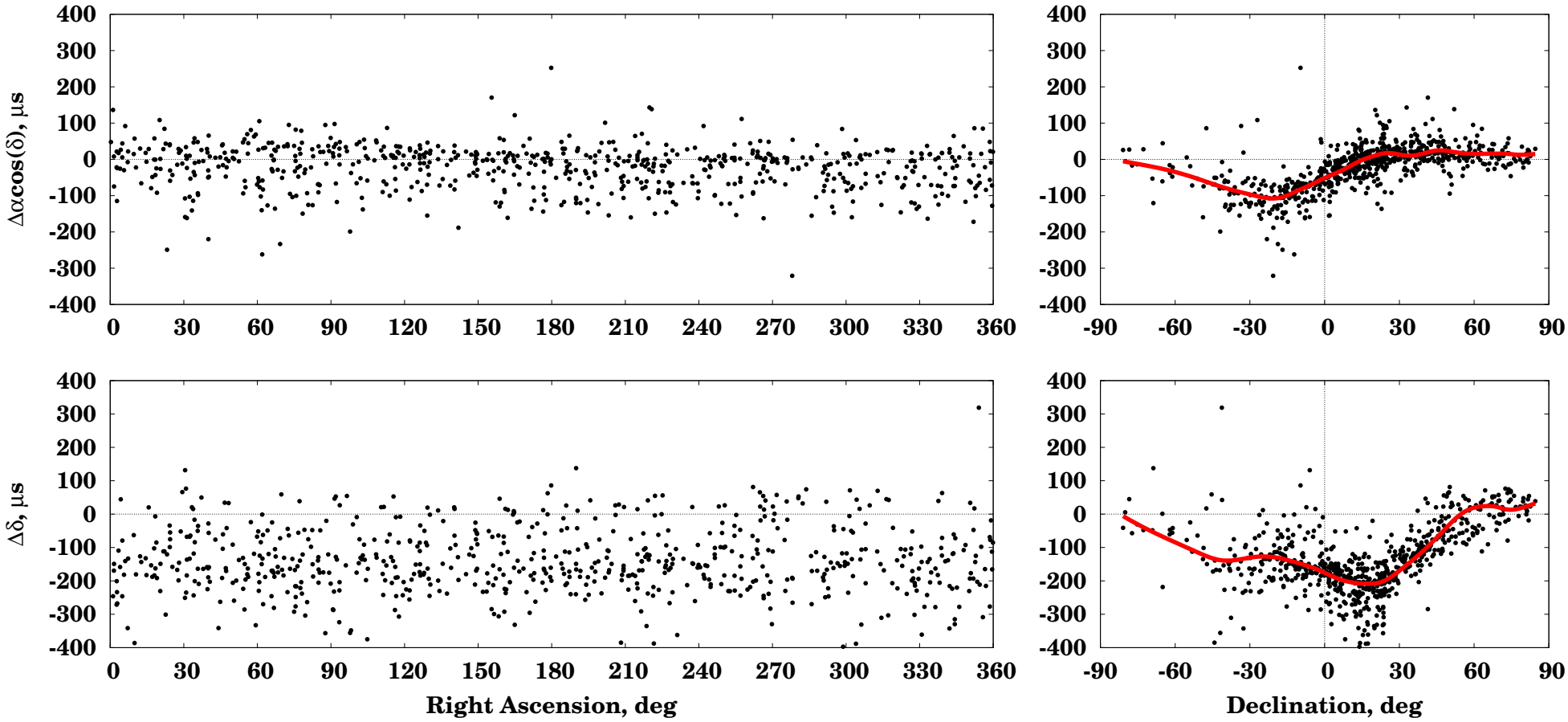
Software:

- SteelBreeze

Estimated parameters:

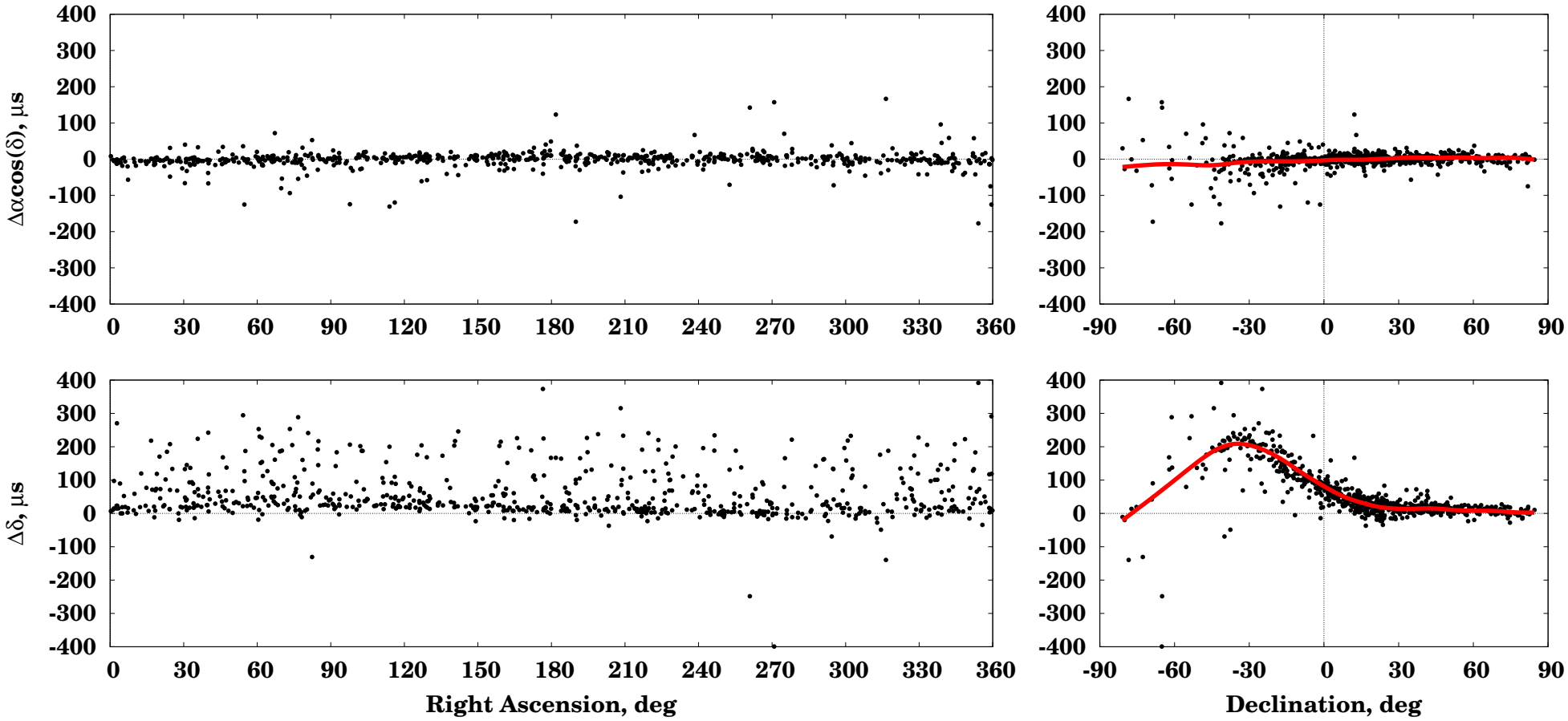
- global parameters: coordinates of radio sources, positions and velocities of VLBI stations
- local parameters: CIP offset (dX and dY), polar motion (p_x and p_y) and $d(UT1 - UTC)$
- stochastic parameters: station clock function, wet zenith delay and its gradients

Run #1: TRF estimation



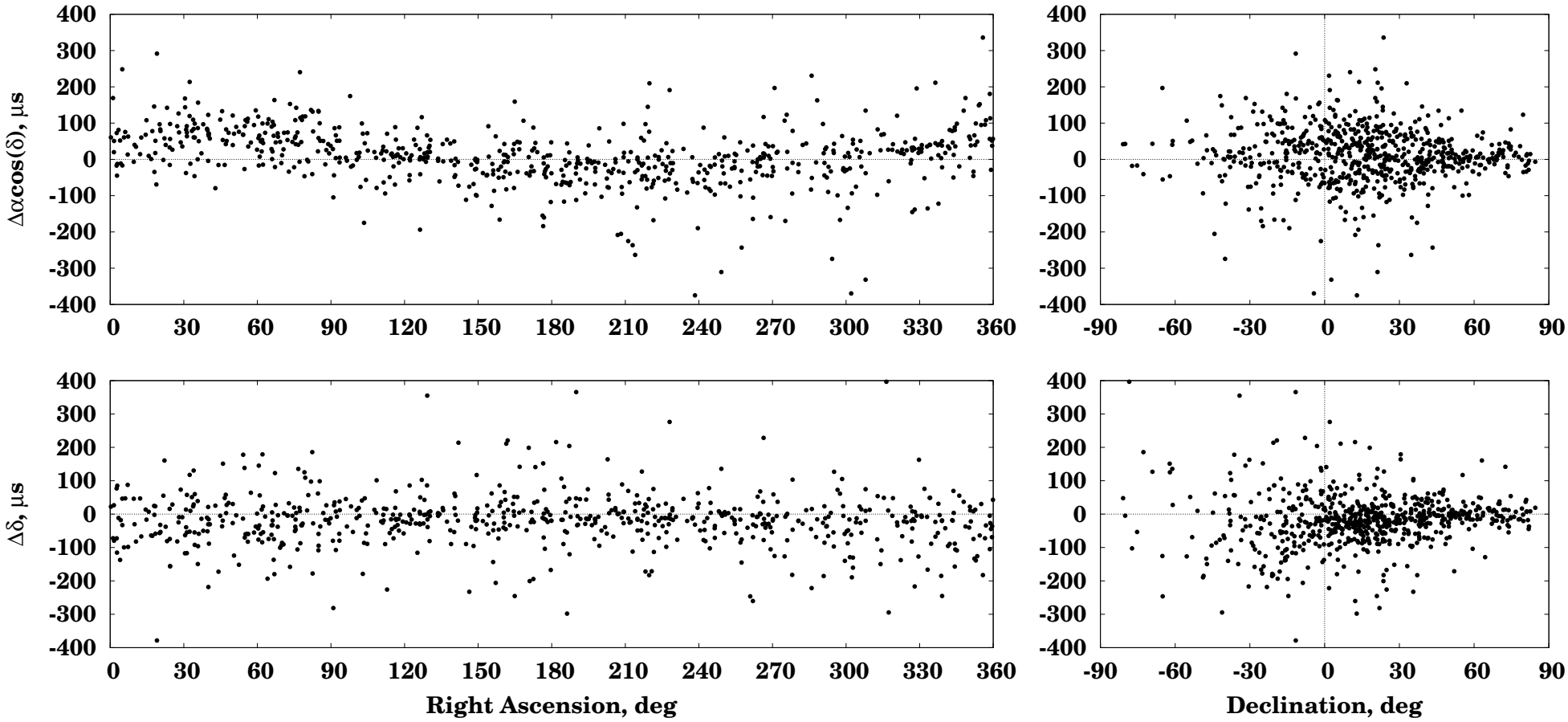
A_1	A_2	A_3	D_α	D_δ	B_δ
6.2	−4.2	26.5	79.4	99.4	−144.3
9.0	9.0	16.0	26.0	15.0	14.0

Run #2: Polar motion estimation



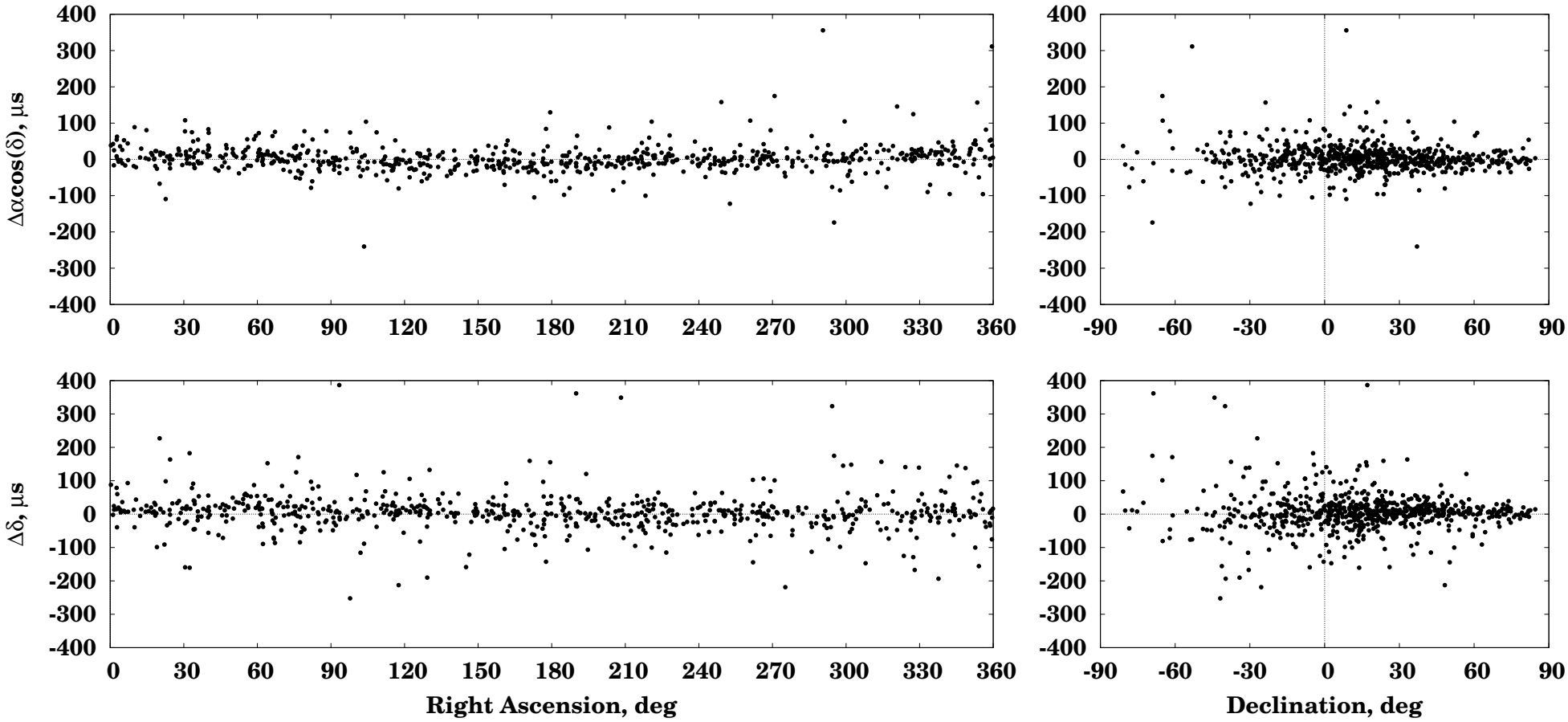
A_1	A_2	A_3	D_α	D_δ	B_δ
-5.5	0.4	5.6	13.1	-23.2	34.7
3.0	3.0	6.0	9.0	5.0	5.0

Run #3: Diurnal & semidiurnal variations in polar motion



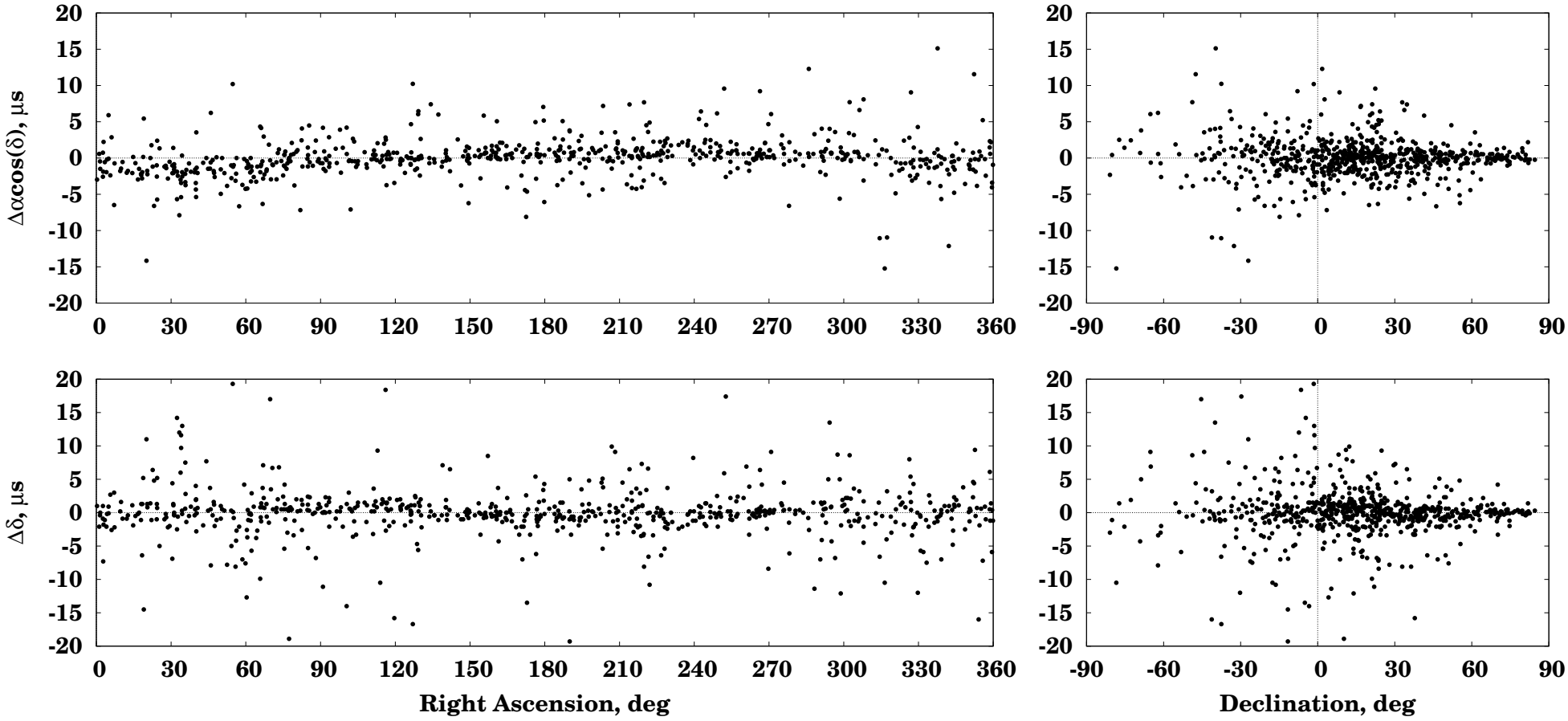
A_1	A_2	A_3	D_α	D_δ	B_δ	C_α	φ_α	C_δ	φ_δ
8.6	-3.9	-7.6	7.8	19.3	25.6	229	54	17	280
5.0	5.0	10.0	15.0	9.0	8.0	4	5	7	20

Run #4: Polar motion subdaily variation estimation



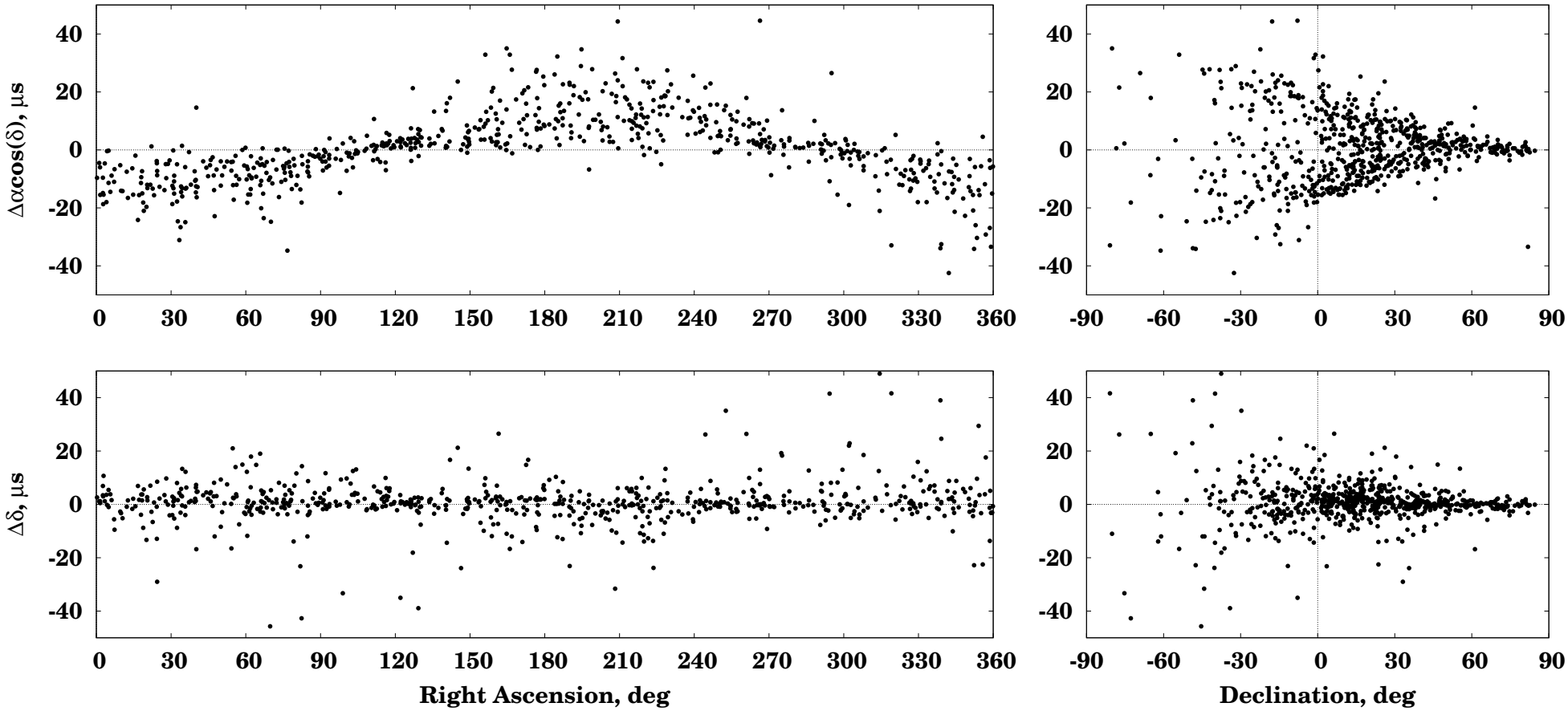
A_1	A_2	A_3	D_α	D_δ	B_δ	C_α	φ_α	C_δ	φ_δ
0.6	1.2	1.7	−3.1	0.8	3.7	12	109	6	21
2.0	2.0	3.0	5.0	3.0	3.0	2	10	4	40

Run #5: A different ocean loading model (CSR3.0 vs GOT002)



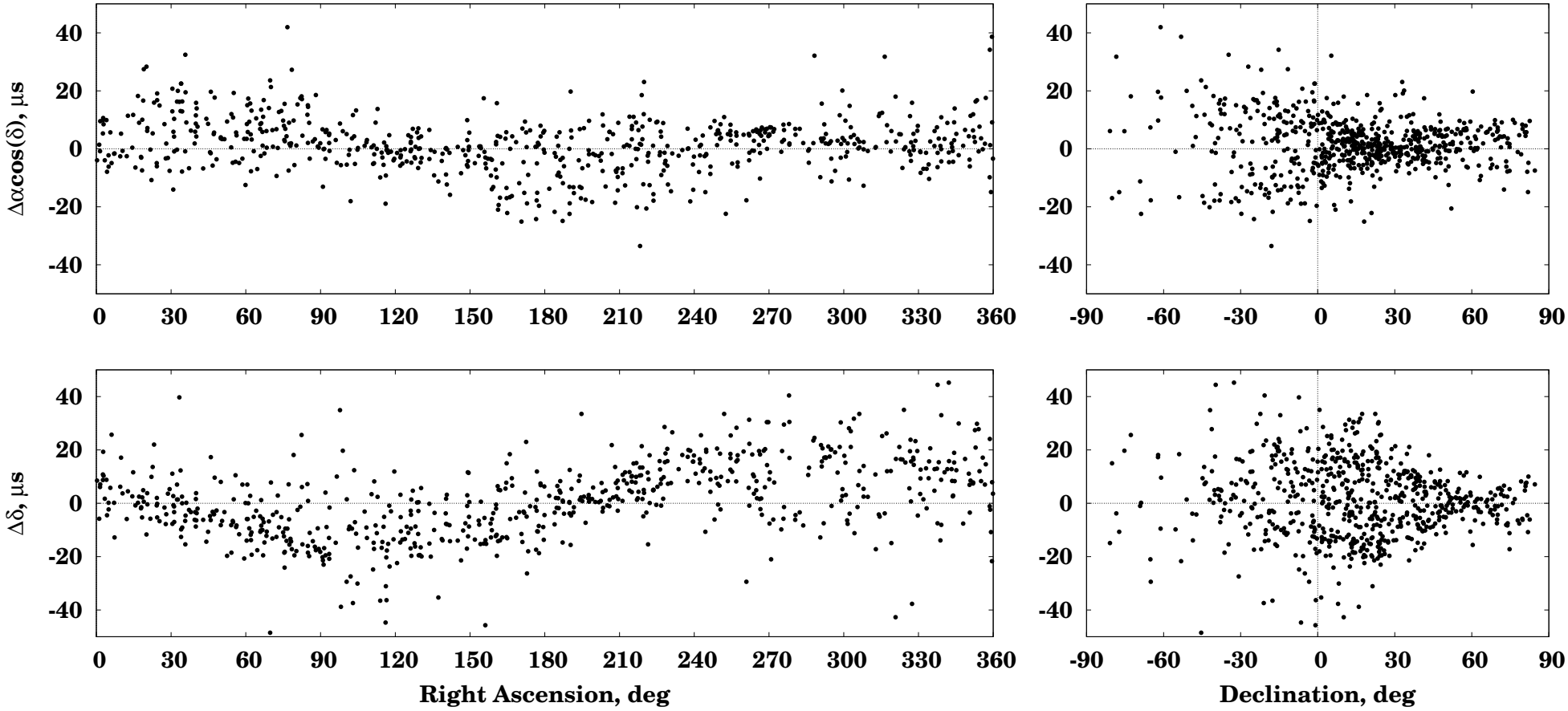
A_1	A_2	A_3	D_α	D_δ	B_δ	C_α	φ_α	C_δ	φ_δ
-0.2	-0.2	0.0	-0.5	0.0	0.0	1.1	233	0.0	
0.1	0.1	0.2	0.3	0.2	0.2	0.1	8	0.3	

Run #6: Nutation model (IAU-2000 vs IAU-1980)



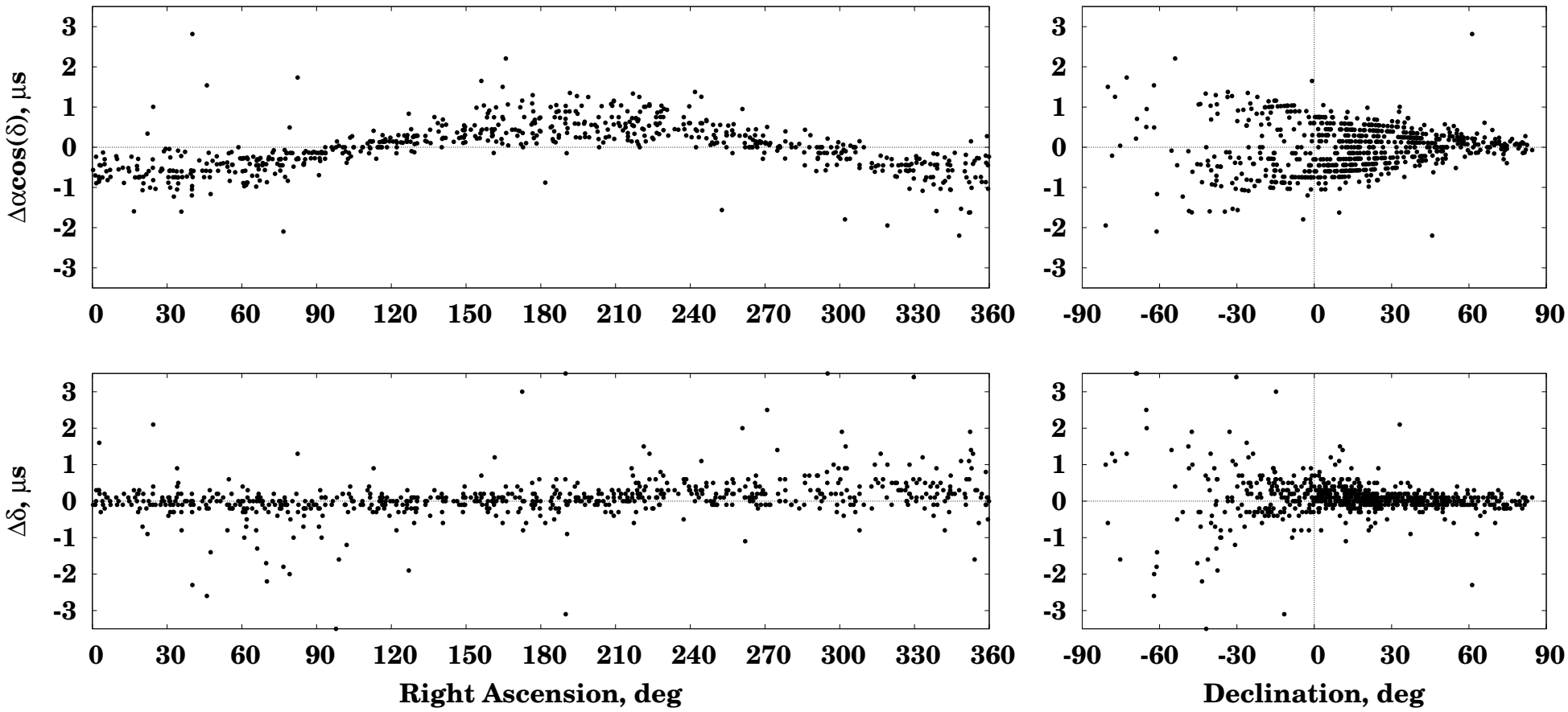
A_1	A_2	A_3	D_α	D_δ	B_δ	C_α	φ_α	C_δ	φ_δ
-1.1	-0.2	-0.8	-1.7	0.1	0.0	13.7	251	1.2	105
1.0	1.0	2.0	3.0	2.0	2.0	0.4	2	0.7	30

Run #7: Effects in solid tides: degree 3 and altitude dependence



A_1	A_2	A_3	D_α	D_δ	B_δ	C_α	φ_α	C_δ	φ_δ
-0.5	0.1	0.9	1.0	-3.8	2.1	4.9	76	12.8	163
1.0	1.0	2.0	3.0	2.0	2.0	0.5	6	0.7	3

Run #8: Influence of atmospheric loading



A_1	A_2	A_3	D_α	D_δ	B_δ	C_α	φ_α	C_δ	φ_δ
-0.10	0.01	0.0	0.0	0.0	0.0	0.64	256	0.31	171
0.06	0.06	0.1	0.2	0.1	0.1	0.02	2	0.03	6

Summary and conclusions

- The difference between coordinates of the reference catalog and the tested one significantly smaller than formal uncertainties,
- Geophysical phenomena which have period close to -1 in TRF are introducing systematic errors, while the other ones – the random ones;
- With respect to new ICRF, the effect of antennae thermal deformation should to be included in data analysis.

Acknowledgments

- Our solutions are based on the VLBI observations provided by the International VLBI Service for Geodesy and Astrometry (IVS).

References

[1] IERS Conventions (2003), IERS Technical Note 32, eds. D.D. McCarthy and G. Petit, Bundesamt für Kartographie und Geodäsie, Frankfurt am Main.

[2] IVS: International VLBI Service data available electronically at http://ivscc.gsfc.nasa.gov

[3] L. Petrov, J.-P. Boy, Study of the atmospheric pressure loading signal in VLBI observations, Journal of Geophysical Research, 10.1029/2003JB002500, Vol. 109, No. B03405, 2004.

[4] Tesmer, V.: Effect of various analysis options on VLBI-determined CRF, Proceedings of the 18th European VLBI for Geodesy and Astrometry Working Meeting, 12-13 April 2007, edited by J. Boehm, A. Pany, and H. Schuh, Geowissenschaftliche Mitteilungen, Heft Nr. 79, Schriftenreihe der Studienrichtung Vermessung und Geoinformation, Technische Universitaet Wien, ISSN 1811-8380.