GPS AND VLBI BASELINE LENGTH VARIATIONS

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1. INTRODUCTION

Observed changes of baseline lengths can be caused by insufficient corrections for observational effects (thermal deformations of VLBI antennas, errors in modeling of tropospheric refraction, etc.) but a number of insufficiently studied or not taken into account properly geophysical effects (atmospheric and snow loading, tides, postglacial rebound, etc.) can result in real changes of baselengths. In this paper we compare baseline length variations derived from GPS and VLBI observations at 6 european stations with long enough observational history.

2. COMPARISON AND RESULTS

Baseline length variations were compared over the period of 1996.0 – 2003.5. VLBI baselengths were computed with the OCCAM package using 24h sessions (Skurikhina, 2000). For more strict account for thermal antenna deformations we used advanced model of this effect (Skurikhina, 2001) which allows to correct observed station position for all types of VLBI mount.

For computation of baseline lengths between european GPS stations we used weekly EPN solutions. These solutions were reprocessed in order to obtain homogeneous coordinate time series since processing strategy with fiducial stations used by EPN can cause a distortion of the network (Malkin and Voinov, 2001). The method of reprocessing is based on deconstraining of the official EPN solutions with further transformation to ITRF2000 (Malkin and Panafidina, 2001). For this study we used 6-parameter Helmert transformation to avoid loss of seasonal geophysical signal in baseline lengths.

One of the most important factor affecting variations of station coordinates is atmospheric loading. We investigated influence of this effect using 3-dimensional atmospheric loading model based on the station displacement time series computed in GSFC. The data were averaged over a week interval corresponding to every GPS week and variations of baselengths were computed from these weekly values.

Results of computation of variations in baseline lengths are presented in the table. Values of rates are in rather good agreement for most baselines but it isn't the case for seasonal variations. Obviously interval of investigation is too short and number of used VLBI observations is too small for many baselines. Also it would be important to verify our results using data obtained from other space geodesy techniques. In this paper we compared the time series spectrums. Ferraz-Mello method of estimation of period from unequally spaced observations (Ferraz-Mello, 1981) was used. The preliminary spectrum analyses showed presence of not only the annual term in all time series but also a two-year term in GPS and VLBI data. The contribution of atmospheric loading to the annual term depends on station separation and can achieve about one third of the amplitude.

Table 1: Results of analysis of variation of baselengths: baseline length (L), km, number of epochs (N) processed and found in the IVS data base, linear trend (Rate), mm, amplitude of annual term (As), mm, amplitude of semiannual term (Asa), mm.

Base	L	VLBI				GPS				Atmospheric loading		
		N	Rate	Aa	Asa	N	Rate	Aa	Asa	Rate	Aa	Asa
MATE	597	47	–1.8	0.8	1.3	367	–2.3	2.5	0.9	0.0	0.3	0.2
MEDI			±0.2	±0.8	±0.8		±0.1	±0.2	±0.2	±0.0	±0.1	±0.1
MATE	444	25	+0.7	2.4	1.5	356	+2.2	1.7	0.2	+0.0	0.2	0.1
NOTO			±0.4	±1.4	±1.5		±0.1	±0.2	±0.2	±0.0	±0.1	±0.1
MATE	4190	95	-2.4	2.7	2.5	330	–6.2	7.9	2.1	0.0	0.4	0.6
NYAL			±0.5	±0.8	±0.8		±0.4	±0.9	±0.9	±0.0	±0.1	±0.1
MATE	1886	48	–5.2	1.3	0.7	372	–5.1	2.8	1.1	0.1	0.4	0.6
ONSA			±0.5	±1.4	±1.5		±0.1	±0.3	±0.3	±0.0	±0.1	±0.1
MATE	990	154	–3.6	2.2	0.9	372	–3.8	1.7	0.6	0.1	0.5	0.9
WETT			±0.2	±0.5	±0.4		±0.1	±0.2	±0.2	±0.0	±0.1	±0.1
MEDI	893	22	–3.2	3.9	3.5	365	–3.1	3.1	0.5	0.0	0.3	0.3
NOTO			±0.4	±1.4	±1.6		±0.1	±0.2	±0.2	±0.0	±0.1	±0.1
MEDI	3776	55	–2.3	3.2	2.2	339	–5.9	7.4	1.8	–0.3	1.4	0.6
NYAL			±0.4	±1.1	±1.3		±0.4	±0.9	±0.9	±0.1	±0.1	±0.1
MEDI	1429	62	–2.8	1.6	0.9	381	–4.0	2.2	4.3	0.0	1.9	1.2
ONSA			±0.5	±1.7	±1.5		±0.1	±0.3	±9.1	±0.0	±0.1	±0.1
MEDI	522	60	–2.6	0.7	0.6	381	–2.8	0.3	0.4	0.0	0.5	0.5
WETT			±0.2	±0.5	±0.4		±0.1	±0.2	±0.2	±0.0	±0.1	±0.1
NOTO	4580	22	–2.4	2.1	4.8	327	–6.1	8.9	2.0	–0.2	0.4	0.5
NYAL			±0.8	±2.5	±2.5		±0.5	±1.0	±1.0	±0.1	±0.1	±0.1
NOTO	2280	24	–5.0	1.4	2.1	370	–4.9	3.9	1.2	0.1	0.2	0.7
ONSA			±0.3	±1.1	±1.2		±0.2	±0.4	±0.4	±0.1	±0.1	±0.1
NOTO	1371	25	–4.5	1.5	1.0	370	–3.9	2.5	0.6	0.2	0.8	0.6
WETT			±0.4	±1.0	±1.7		±0.1	±0.3	±0.3	±0.1	±0.1	±0.1
NYAL	2387	71	0.6	1.8	2.5	344	–1.3	5.1	1.1	0.0	1.2	1.1
ONSA			±0.5	±1.4	±1.3		±0.3	±0.6	±0.6	±0.0	±0.2	±0.1
NYAL	3283	367	+1.0	2.5	1.1	344	–2.9	6.8	1.6	0.6	0.7	1.2
WETT			±0.1	±0.3	±0.3		±0.3	±0.7	±0.7	±0.1	±0.2	±0.2
ONSA	919	90	–1.0	0.8	0.8	386	–1.4	1.9	0.6	0.1	0.9	0.7
WETT			±0.3	±0.8	±0.8		±0.1	±0.2	±0.2	±0.0	±0.1	±0.1

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