CONT11 - High-Frequency Earth Rotations Variations from VLBI Observations

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Results of data processing of CONT11 15 day campaign of continuous VLBI sessions with a network of eleven globally distributed stations in September 2011 with participation of two stations of Russian QUASAR network stations Badary and Zelenchukskaya are presented.
Preliminary analysis results on EOP precision, baseline length precision are discussed. The observed intraday variations EOP are compared with a tidal model and with results of previous CONT campaigns. Troposphere parameters are compared with ones obtained with GPS technique.
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Observations on the program CONT11 are a continuation of a series of previous successful campaigns of continuous observations: CONT94 (January 1994), CONT95 (August 1995), CONT96 (end of 1996), within the framework of international VLBI Service IVS-week campaign of continuous observations: held regularly every three years, it is is the fourth campaign. Comparative characteristics campaigns CONT shown in Tables 1 and 2

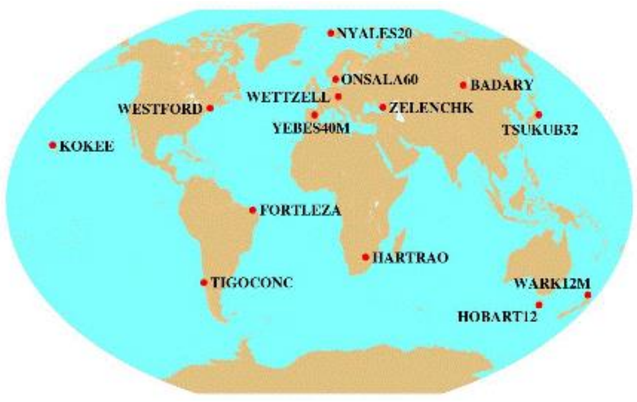


Figure 1 CONT11 network

VLBI station	Location	D(m)	collocation			
			GPS	SLR	DORIS	WVR
BADARY	«Badary, Russia	32	BADA		8	
HARTRAO	«Hartebeesthoek», S Africa	26	HRAO	HARL	HBLA	
HOBART12	«12m, Hobart», Tasmania	12	HOB2			
KOKEE	«Kokee Park», Kauai, HI	25	KOKB			WVR1100
FORTLEZA	«Fortaleza», Brazil	14.2	FTBR			
NYALES20	«Ny-Alesund» Norway	20	NYA1			
ONSALA60	«Onsala», Sweden	20	ONSA			WVR Astrid
TIGOCONC	«TIGO, Concepcion», Chile	6	CONS	CONL	SANB	
TSUKUB32	«Tsukuba» , Japan	32	TSKB			WVR26, 28
WESTFORD	«Westford», USA	18	WES2			
WETTZELL	«Wettzell», Germany	20	WTZL	WETL		WVR1100
YEBES40M	«Yebes», Spain	40	YESS			
ZELENCHK	«Zelenchukskaya» , Russia,	32	ZECK			

Table 2. CONT11 network

From Table 1 it is possible to trace the progress of the VLBI technology, because the main goal of the campaign is to demonstrate CONT maximum possible accuracy of the observations, which can provide both the VLBI technique for a two-week time frame. The main scientific goal is to continue the study of Earth's rotation with a high temporal resolution for the study of high tidal variations. Feature of the campaign schedule and CONT11 CONT08 is the continuity of observations. If CONT02 and CONT05 had hourly intervals between sessions daily for solutions to various technical problems, for the campaign period for technical breaks for each of the stations do not overlap. Also the beginning of the sessions in 0:00:00 UT allows you to make a more valid comparison with the data obtained from the GPS / GLONASS observations..

CONT	*Observation time*	*Stations numberŭ*	*Registion system*	*V registration Mbit/c*	collocation	*correlator*
CONT94	January 1994	7	Mk3	128	WVR	Haystack
CONT95	August. 1995	6	Mk3	128		WACO
CONT96	November 1996	5	Mk3	128	WVR	WACO
IVS CONT02	October 2002	8	VLBA Mk34	256	GPS , SLR DORIS WVR(3)	WACO Bonn Haystack
IVS CONT05	September 2005	11	Mark 4	256	GPS, SLR(3) DORIS(4) WVR(5)	WACO Bonn Haystack
IVS CONT08	August 2008	11	Mk5	512	GPS, SLR(3) DORIS(4) WVR(5)	WACO
IVS CONT11	cSeptember 2011	14	Mark5A/ Mark5B	512	GPS, SLR(3) DORIS(5) WVR(?)	WACO

Table 1. CONTs specification

IVS-CONT	Number of		
	scans	observations	sources
CONT02	6946	49826	49
CONT05	12952	96437	74
CONT08	17272	153738	80
CONT11	16430	145214	114

Table 3. IVS CONT observation statistic

As the evaluation accuracy can be used EOP average error formal definition EOP and standard deviation (SD) of several IERS C04 08 after subtracting systematic differences (Table 4) and recurrence bases lengths. Repeatability lengths bases was 0.43 ppb, for comparison to CONT08 - 0.94 ppb, for CONT05 - 1.39 ppb.

IVS CONT	Expected accuracy		Formal accuracy		RMS EOP(IERS-CONT)		
	Xp,Yp µas	UT1 µs	Xp,Yp µas	UT1 µs	Xp,Yp µas	UT1 µs	Xc,Yc µas
CONT02	60	2	53	2.2	84	7.9	86
CONT05	40	1.5	26	1.1	56	4.6	102
CONT08	35	1.3	24	1.1	42	4.1	69
CONT11	35	1.5	22	1.3	40	4.3	69

Table 4. EOP accuracy from IVS-CONT

All the observations were processed at the correlator WACO. Sessions corresponding to the IVS-R1 and IVS-R4 went and were correlated in emergency mode sessions. These sessions were correlate twice - first as an urgent session and then as part of a smooth continuous session. Observations at stations Wetzel, Cookie, Tsukuba, New Alesund program IVS-Intensive (hourly session to determine Universal Time) continued throughout the period of observation program CONT11. Determination of the World have been conducted continuously in near-real-time at the base ONSALA60-TSUKUB32.

Secondary data processing of CONT11 observations was carried out using a OCCAM/GROSS soft. In the calculation of diurnal EOP 15 daily sessions were combined into one 15-day session (consisting of 16430 scans and 145,214 delays), which has been processed using a package OCCAM / GROSS using the forward run of the Kalman filter to estimate the stochastic parameters. As stochastic parameters are considered EOP (pole coordinates and universal time), the date, time, wet component of the tropospheric delay at the zenith (WZD). The behavior of stochastic parameters of simulated random walk process. As a priori parameters were used the following values: a priori variance for EOP - 1 mas ², a priori spectral density for EOP - 1 mas ² / day. Unlike standard treatment regimen is shown in Table 5.

EOP service solution (daily EOP)	**Constant parameters: Xp, Yp, UT1, Xc, Yc** **Stohastic prameters: WZD, clock** **A-priory standart deviation of EOP: 100 mas**
Intraday EOP solution (Xp, Yp, UT1)	**Constant parameters: Xc, Yc** **Stohastic prameters: Xp, Yp, UT1, WZD, clock** **A-priory standart deviation of EOP: 1 mas.** **A-priory Power Spectral Dencity : 10 mas²/day.**

Table 5. Distinction these solution from EOP service solution

at the zenith obtained by GPS and VLBI observations. Figure. 2 shows the diurnal variations of terrestrial pole coordinates and universal time.

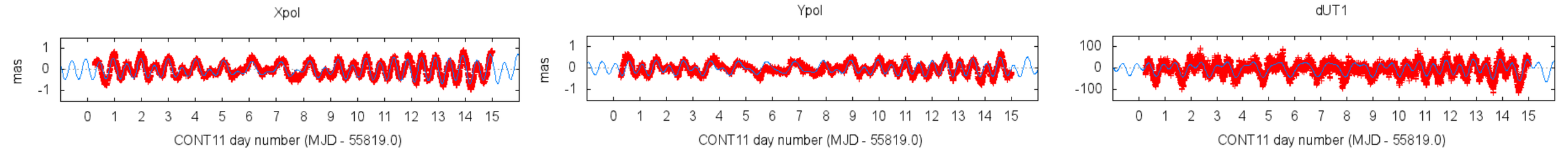
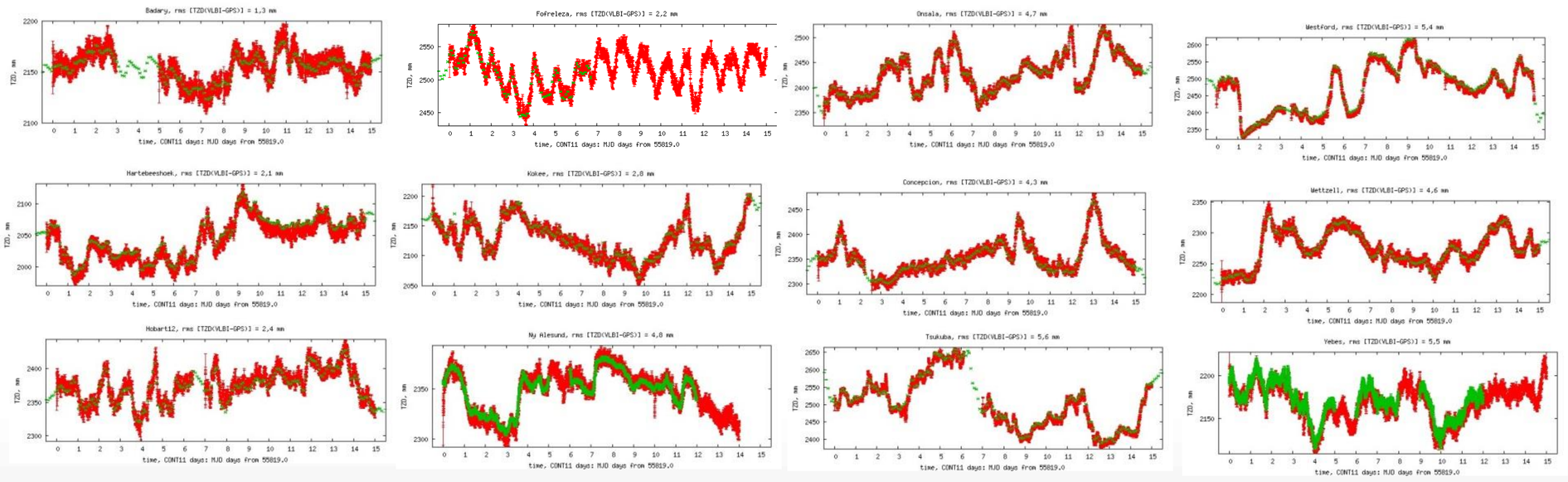


Fig. 2. Diurnal variation of Xp, Yp and Ut1 compared with the model of diurnal variations of EOP IERS Conventions 2010, and the horizontal axis the number of days CONT11: MJD - 55819. SKO (Xp - model) = 167µas, RMS (Yp-model) = 164 µas, RMS (dUT1-model) = 18 µs



Plans for the future:
Analysis of diurnal variations of OBP
The observations using the software package QUASAR, the comparison of results.

Fig. 3. The zenith tropospheric delay (TZD - total zenith delay): VLBI data are shown in red, green - these GPS (for stations in Ny Alesund Yebes used for comparison data USNO, for other stations - CODE)