Institute of Applied Astronomy RAS

CONT14 - 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 CONT14 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 fifth campaign. Comparative characteristics campaigns CONT shown in Tables 2 and 3

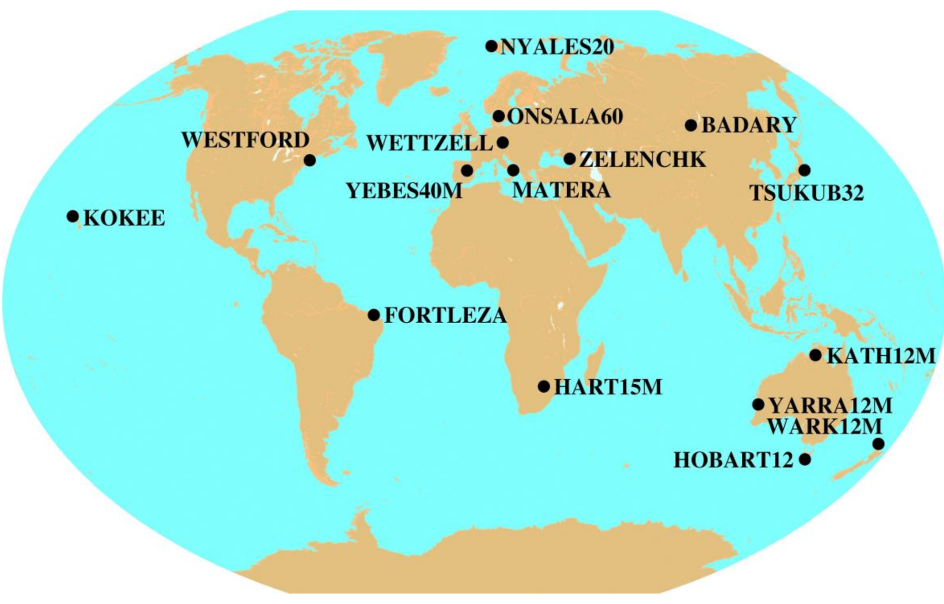


Figure 1 CONT14 network

VLBI station	Location	D(m)	Data used		Data available			
			N scan	% rec	Cab Cal	T	P	H
BADARY	Badary Radio Astronomical Observatory, Russia	32	6337	92	+	+	+	+
HART5M	Hartebeesthoek Radio Astronomy Observatory, South Africa	26	6219	100	-	+	+	+
FORTLEZA	Space Radio Observatory of the Northeast (ROEN), Fortaleza, Brazil	14.2	5219	100	+	-	-	-
HOBART12	Mt. Pleasant Radio Astronomy Observatory, Hobart, TAS, Australia	12	6812	98	-	+	+	+
HOBART26	Mt. Pleasant Radio Astronomy Observatory, Hobart, TAS, Australia	26	6887	95	-	+	+	+
KATH12M	Katherine Observatory, Katherine, NT, Australia	12	6322	97	-	+	+	+
KOKEE	Kokee Park Geophysical Observatory, Kauai, HI, USA	25	7001	97	-	+	+	+-
MATERA	Centro di Geodesia Spaziale G. Colombo, Matera, Italy	32	6119	96	+	+	+	+
NYALES20	Ny Alesund Geodetic Observatory, Spitsbergen, Norway	20	6999	99	+	+	+	+
ONSALA60	Onsala Space Observatory, Sweden	20	6251	99	+	+	+	+
TSUKUB32	Tsukuba VLBI Station, Japan	32	8347	98	+	+	+	+
WARK12M	Warkworth VLBI Station, New Zealand	12	5771	100	-	+	+	+
WESTFORD	Westford Antenna, Haystack Observatory, MA, USA	18	7117	100	+	+	+	+
WETTZELL	Fundamentalstation Wettzell, Germany	20	6889	96	+	+	+	+
YARRA12M	Yarragadee Observatory, Yarragadee, WA, Australia	12	6103	100	-	+	+	+
YEBES40M	Astronomical Center at Yebes, Spain	40	6894	99	+	+	+	+
ZELENCHK	Radioastronomical Observatory Zelenchukskaya, Russia	32	6567	96	+	+	+	+

Table 1. CONT14 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 for CONT14, 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..

All the observations were processed at the BONN correlator. Sessions corresponding to the IVS-R1 and IVS-R4 went and were correlated in emergency mode sessions. Stations HOBART26, HOBART12M, HART15M, KATH12M, NYALES20, TSUKUB32, WARK12M and YARRA12M used e-transter data to the Bonn Correlator:,. Observations of Fortleza were e-transferred from WACO to BONN . Determination of the World have been conducted continuously in near-real-time at the base ONSALA60-TSUKUB32.

CONT	*Observation time*	*Stations numberrü*	*Regision 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	September 2011	14	Mark5A/ Mark5B	512	GPS, SLR(3) DORIS(5) WVR(?)	WACO
IVS CONT14	May 2014	17	Mark5B	512	GPS, SLR(5) DORIS(5) WVR(?)	BONN

Table 2. 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
CONT14	23040	287275	73

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)

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
CONT14	35	1.5	17.5	1.1	74	11.6	72

Table 4. EOP accuracy from IVS-CONT

Secondary data processing of CONT14 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 23040 scans and 287 275 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

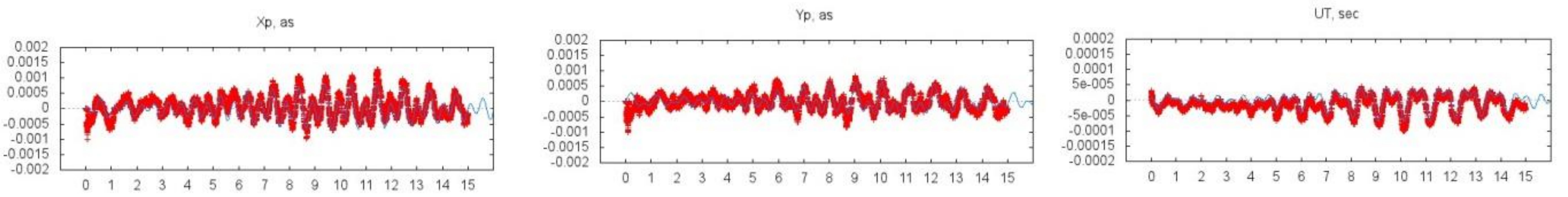
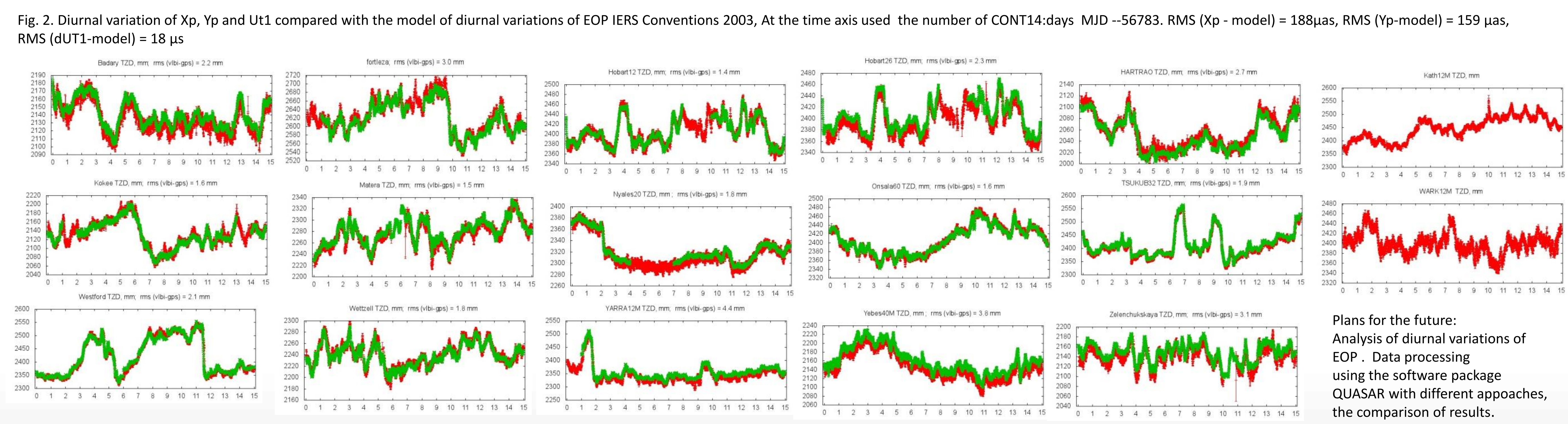


Fig. 2. Diurnal variation of Xp, Yp and Ut1 compared with the model of diurnal variations of EOP IERS Conventions 2003, At the time axis used the number of CONT14:days MJD --56783. RMS (Xp - model) = 188µas, RMS (Yp-model) = 159 µas, RMS (dUT1-model) = 18 µs



Plans for the future:
Analysis of diurnal variations of EOP . Data processing using the software package QUASAR with different appoaches, the comparison of results.

Fig. 3. The zenith tropospheric delay (TZD - total zenith delay): VLBI data are shown in red, green – TZD from GPS (USNO data center) , At the time axis used the number of CONT14:days MJD –56783.

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