MAIN
METROLOGICAL
CENTER
RUSSIAN FEDERATION

VNIIFTRI

National Research Institute for Physical-Technical
and Radio Engineering Measurements (VNIIFTRI)

Pasynok S. L., Bezmenov I.V., Kaufman M. B.

Operative EOP activities in VNIIFTRI

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JOURNEESE 2014

VNIIFTRI as the Russian Main Metrological Center of Time, Frequencies and Earth Rotation Service carried out the rapid EOP processing based on GNSS, VLBI and SLR observations for many years.

VNIIFTRI takes participation in GNSS and SLR observations of IGS and ILRS too.

The EOP activities at VNIIFTRI can be grouped in four basic topics:

1) Processing GNSS, SLR and VLBI observation data for EOP evaluation;
2) Combination of EOP series for evaluation of reference EOP values;
3) Combination of GLONASS satellites orbit/clock;
4) Providing GNSS and SLR observations at five metrological sites acting under the auspices of Federal Agency on Technical Regulating of Metrology(ROSSTANDART).

1) Processing GNSS, SLR and VLBI observation data for EOP evaluation

Processing of measurements by phase GPS in VNIIFTRI has been started in 1999.

Today EOP from GPS are obtained by processing of measurements on a Russian network, which includes approximately 35 GNSS receivers of the various organizations and departments(RSA , RAS, ROSSTANDART and others) .

Processing is carried out with the help of a program package BERNESE 5.0 (IAUB).

From 2004 EOP evaluations from VLBI technique are carried out with the help of software package OCCAM version 5.0, specially adapted to the rapid service mode.

In 2011 we began to process of new series of VLBI data using VieVS software developed at the Institute of Geodesy and Geophysics (IGG), Vienna University of Technology.

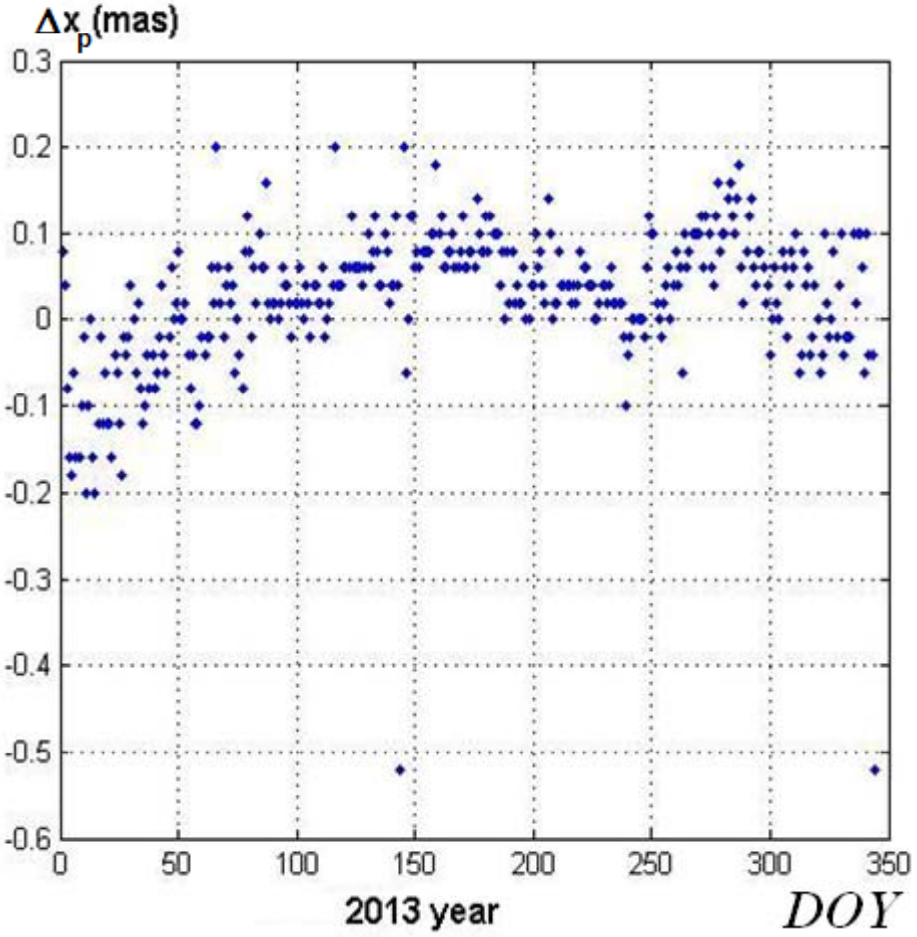
Now VLBI observations are processed in VNIIFTRI with the help of OCCAM and VieVs package.

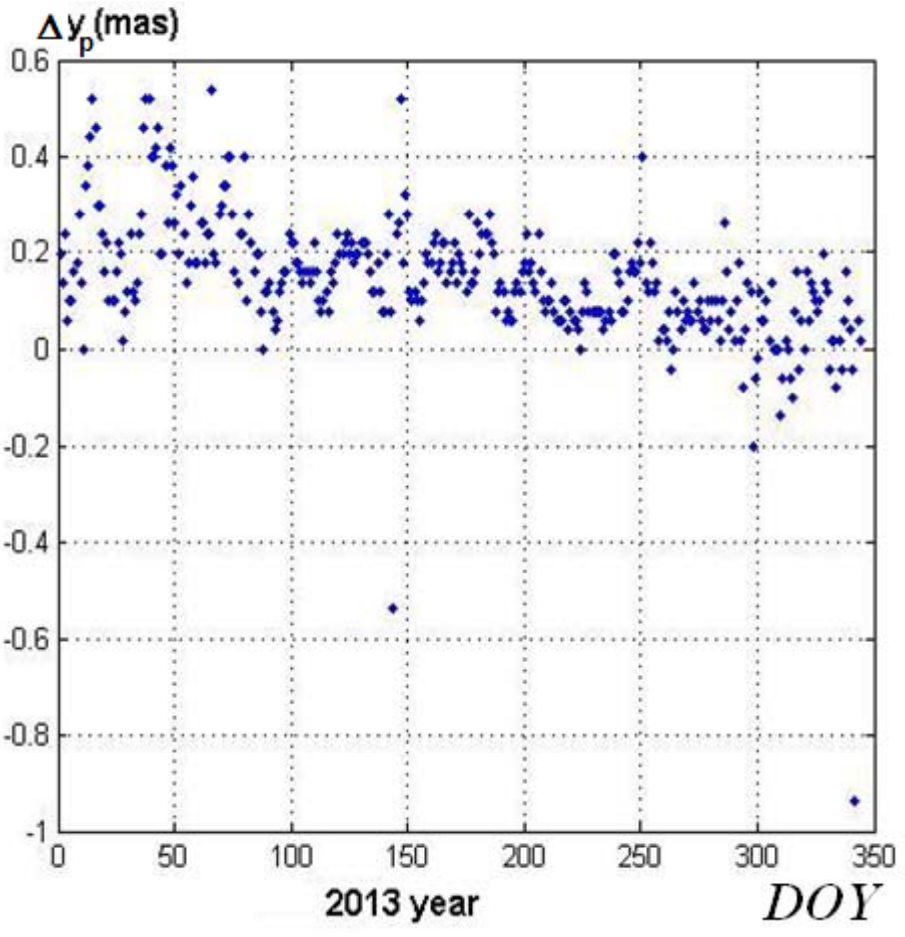
Using of SLR observations of the Lageos-1 and Lageos-2 has been started in 1995.
Processing was carried out with the help of a program package ITALAS (IAA). But the facilities and ideas which were realized in this program many years ago are not allowed to evaluate EOP with accuracy what is required now. So, using of this program for EOP evaluation in VNIIFTRI were stopped.

The preparation for renewal of regular operative calculations of EOP based on results of SLR measurements is conducted. As a base software product the BERNESE 5.2 is chosen. The additional blocks considering features of laser observations and program are developed by E. Tsyba and M. Kaufman and presentation one can see on the poster:

*4.14. Tsyba E., **Kaufman M.** Improvement of the software Bernese for calculation of the Earth rotation parameters according to the data of satellite laser ranging (Lageos 1, Lageos 2) in the Main Metrological Centre of the State Time and Frequency Service*
(Poster, Journees 2014)

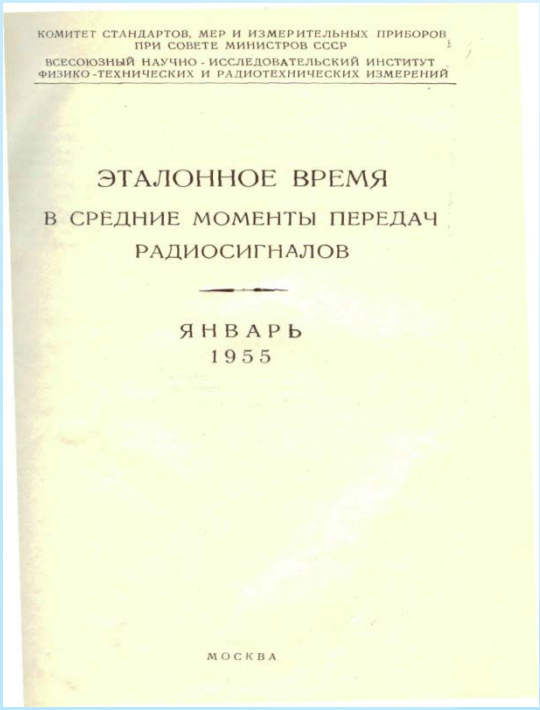
Differences between EOP evaluated by the this program and EOPC04 series are shown at the picture





2) Rapid combination of EOP series for evaluation of reference EOP values

Rapid combination of EOP for evaluation of reference EOP values has been started in VNIIFTRI at 1955.


КОМИТЕТ СТАНДАРТОВ, МЕР И ИЗМЕРИТЕЛЬНЫХ ПРИБОРОВ
ПРИ СОВЕТЕ МИНИСТРОВ СССР
ВСЕСОЮЗНЫЙ НАУЧНО - ИССЛЕДОВАТЕЛЬСКИЙ ИНСТИТУТ
ФИЗИКО-ТЕХНИЧЕСКИХ И РАДИОТЕХНИЧЕСКИХ ИЗМЕРЕНИЙ

ЭТАЛОННОЕ ВРЕМЯ
В СРЕДНИЕ МОМЕНТЫ ПЕРЕДАЧ
РАДИОСИГНАЛОВ

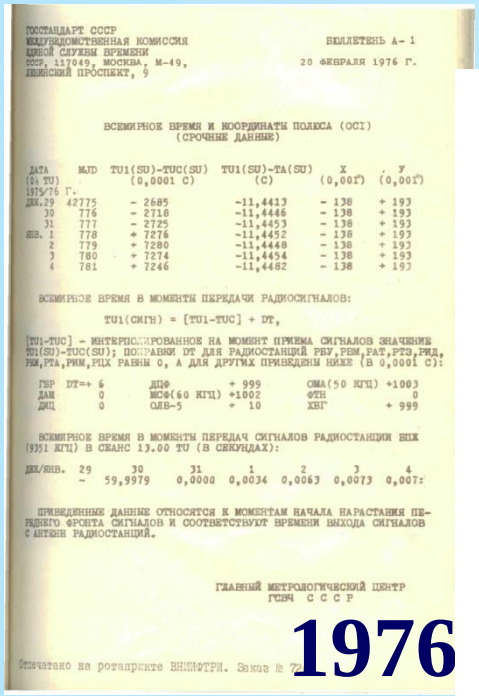
ЯНВАРЬ
1955

МОСКВА

D.U. Belocerkovskii
- first head of EOP laboratory VNIIFTRI

M.B. Kaufman
14.02.1938-20.04.2014

The form of bulletins and processing methods were changing in process of development of new methods of measurements and improvement of technics. D.U. Belocerkovskii D. Yu. and Kaufman M. B. were that scientists who were leading this work in VNIIFTRI.



ГОССТАНДАРТ СССР
МЕЖВЕДОМСТВЕННАЯ КОМИССИЯ ПО ЕДИНОЙ СЛУЖБЕ ВРЕМЕНИ
СССР, 117049, МОСКВА, М-49, ЛЕНИНСКИЙ ПРОСПЕКТ, 9

БЮЛЛЕТЕНЬ А-1
20 ФЕВРАЛЯ 1976 Г.

ВСЕМИРНОЕ ВРЕМЯ И КООРДИНАТЫ ПОЛЮСА (ОСИ)
(СРОЧНЫЕ ДАННЫЕ)

ДАТА (0h UT)	MJD	UT1(SU)-TUC(SU) (0,0001 С)	UT1(SU)-TA(SU) (С)	X (0,001")	Y (0,001")
1975/76 Г.					
ДЕК.29	42775	- 2685	-11,4413	- 138	+ 193
30	776	- 2718	-11,4446	- 138	+ 193
31	777	- 2725	-11,4453	- 138	+ 193
ЯНВ. 1	778	+ 7276	-11,4452	- 138	+ 193
2	779	+ 7280	-11,4448	- 138	+ 193
3	780	+ 7274	-11,4454	- 138	+ 193
4	781	+ 7246	-11,4482	- 138	+ 193

ВСЕМИРНОЕ ВРЕМЯ В МОМЕНТЫ ПЕРЕДАЧИ РАДИОСИГНАЛОВ:

TU1(СИГН) = [TU1-TUC] + DT,

[TU1-TUC] - ИНТЕРПОЛИРОВАННОЕ НА МОМЕНТ ПРИЕМА СИГНАЛОВ ЗНАЧЕНИЕ TU1(SU)-TUC(SU); ПОПРАВКИ DT ДЛЯ РАДИОСТАНЦИЙ РБУ,РБМ,ГАТ,РТЗ,РИД, РБМ,РТА,РИМ,РЦХ РАВНЫ 0, А ДЛЯ ДРУГИХ ПРИВЕДЕНЫ НИЖЕ (В 0,0001 С):

ГБР	DT=+ 6	ДПФ	+ 999	ОМА(50 КГЦ)	+1003
ДАМ	0	МСФ(60 КГЦ)	+1002	ФТН	0
ДИД	0	ОДБ-5	+ 10	ХБГ	+ 999

ВСЕМИРНОЕ ВРЕМЯ В МОМЕНТЫ ПЕРЕДАЧ СИГНАЛОВ РАДИОСТАНЦИИ ВНИИФТРИ (9351 КГЦ) В СЕАНС 13.00 ТО (В СЕКУНДАХ):

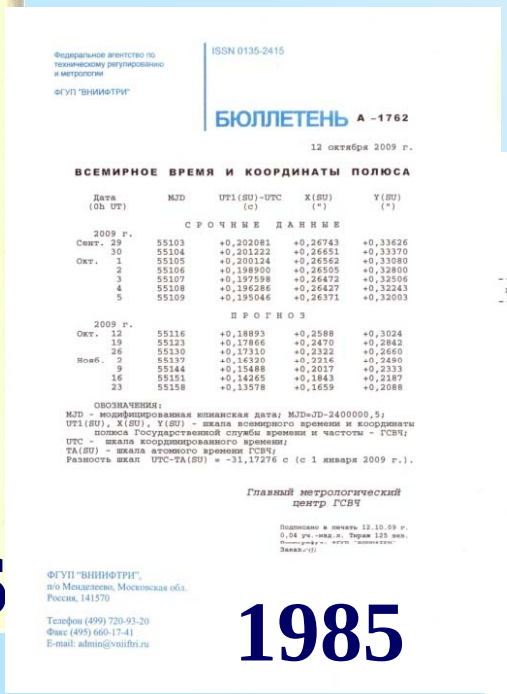
ДЕК/ЯНВ.	29	30	31	1	2	3	4
	-	59,9979	0,0000	0,0034	0,0063	0,0073	0,007:

ПРИВЕДЕННЫЕ ДАННЫЕ ОТНОСЯТСЯ К МОМЕНТАМ НАЧАЛА НАРАСТАНИЯ ПЕРЕДНЕГО ФРОНТА СИГНАЛОВ И СООТВЕТСТВУЮТ ВРЕМЕНИ ВЫХОДА СИГНАЛОВ С АНТЕНН РАДИОСТАНЦИЙ.

ГЛАВНЫЙ МЕТРОЛОГИЧЕСКИЙ ЦЕНТР ГСВЧ СССР

Отпечатано на ротапринте ВНИИФТРИ. Заказ № 72

1976



Федеральное агентство по техническому регулированию и метрологии
ФГУП "ВНИИФТРИ"

ISSN 0135-2415

БЮЛЛЕТЕНЬ А-1762

12 октября 2009 г.

ВСЕМИРНОЕ ВРЕМЯ И КООРДИНАТЫ ПОЛЮСА

Дата (0h UT)	MJD	UT1(SU)-UTC (с)	X(SU) (")	Y(SU) (")
		СРОЧНЫЕ ДАННЫЕ		
2009 г.				
Сент. 29	55103	+0,202081	+0,26743	+0,33626
30	55104	+0,201222	+0,26651	+0,33370
Окт. 1	55105	+0,200124	+0,26562	+0,33080
2	55106	+0,198900	+0,26505	+0,32800
3	55107	+0,197598	+0,26472	+0,32506
4	55108	+0,196286	+0,26427	+0,32243
5	55109	+0,195046	+0,26371	+0,32003
		ПРОГНОЗ		
2009 г.				
Окт. 12	55116	+0,18893	+0,2588	+0,3024
19	55123	+0,17866	+0,2470	+0,2842
26	55130	+0,17310	+0,2322	+0,2660
Нояб. 2	55137	+0,16320	+0,2216	+0,2490
9	55144	+0,15488	+0,2017	+0,2333
16	55151	+0,14265	+0,1843	+0,2187
23	55158	+0,13578	+0,1659	+0,2088

ОБОЗНАЧЕНИЯ:
MJD - модифицированная юлианская дата; MJD=JD-2400000,5;
UT1(SU), X(SU), Y(SU) - шкала всемирного времени и координаты полюса Государственной службы времени и частоты - ГСВЧ;
UTC - шкала координированного времени;
TA(SU) - шкала атомного времени ГСВЧ;
Разность шкал UTC-TA(SU) = -31,17276 с (с 1 января 2009 г.).

Главный метрологический центр ГСВЧ

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Типография ФГУП "ВНИИФТРИ"
Заказ

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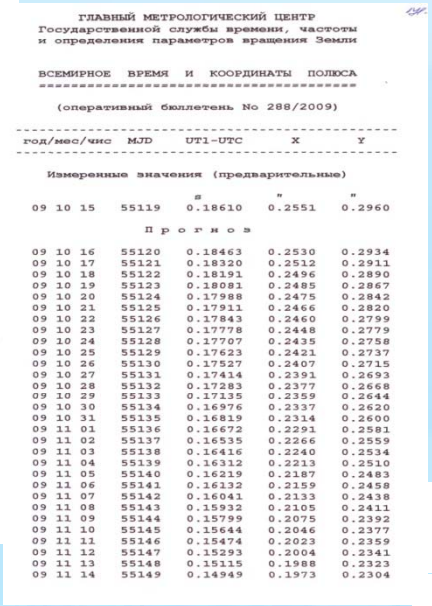
1985



ГЛАВНЫЙ МЕТРОЛОГИЧЕСКИЙ ЦЕНТР
Государственной службы времени, частоты и определения параметров вращения Земли

ВСЕМИРНОЕ ВРЕМЯ И КООРДИНАТЫ ПОЛЮСА

(оперативный бюллетень No 288/2009)

год/мес/чис	MJD	UT1-UTC	X	Y
			"	"
Измеренные значения (предварительные)				
09 10 15	55119	0.18610	0.2551	0.2960
Прогноз				
09 10 16	55120	0.18463	0.2530	0.2934
09 10 17	55121	0.18320	0.2512	0.2911
09 10 18	55122	0.18191	0.2496	0.2890
09 10 19	55123	0.18081	0.2485	0.2867
09 10 20	55124	0.17988	0.2475	0.2842
09 10 21	55125	0.17911	0.2466	0.2820
09 10 22	55126	0.17843	0.2460	0.2799
09 10 23	55127	0.17778	0.2448	0.2779
09 10 24	55128	0.17707	0.2435	0.2758
09 10 25	55129	0.17623	0.2421	0.2737
09 10 26	55130	0.17527	0.2407	0.2715
09 10 27	55131	0.17414	0.2391	0.2693
09 10 28	55132	0.17283	0.2377	0.2668
09 10 29	55133	0.17135	0.2359	0.2644
09 10 30	55134	0.16976	0.2337	0.2620
09 10 31	55135	0.16819	0.2314	0.2600
09 11 01	55136	0.16672	0.2291	0.2581
09 11 02	55137	0.16535	0.2266	0.2559
09 11 03	55138	0.16416	0.2240	0.2534
09 11 04	55139	0.16312	0.2213	0.2510
09 11 05	55140	0.16219	0.2187	0.2483
09 11 06	55141	0.16132	0.2159	0.2458
09 11 07	55142	0.16041	0.2133	0.2438
09 11 08	55143	0.15932	0.2105	0.2411
09 11 09	55144	0.15799	0.2075	0.2392
09 11 10	55145	0.15644	0.2046	0.2377
09 11 11	55146	0.15474	0.2023	0.2359
09 11 12	55147	0.15293	0.2004	0.2341
09 11 13	55148	0.15115	0.1988	0.2323
09 11 14	55149	0.14949	0.1973	0.2304

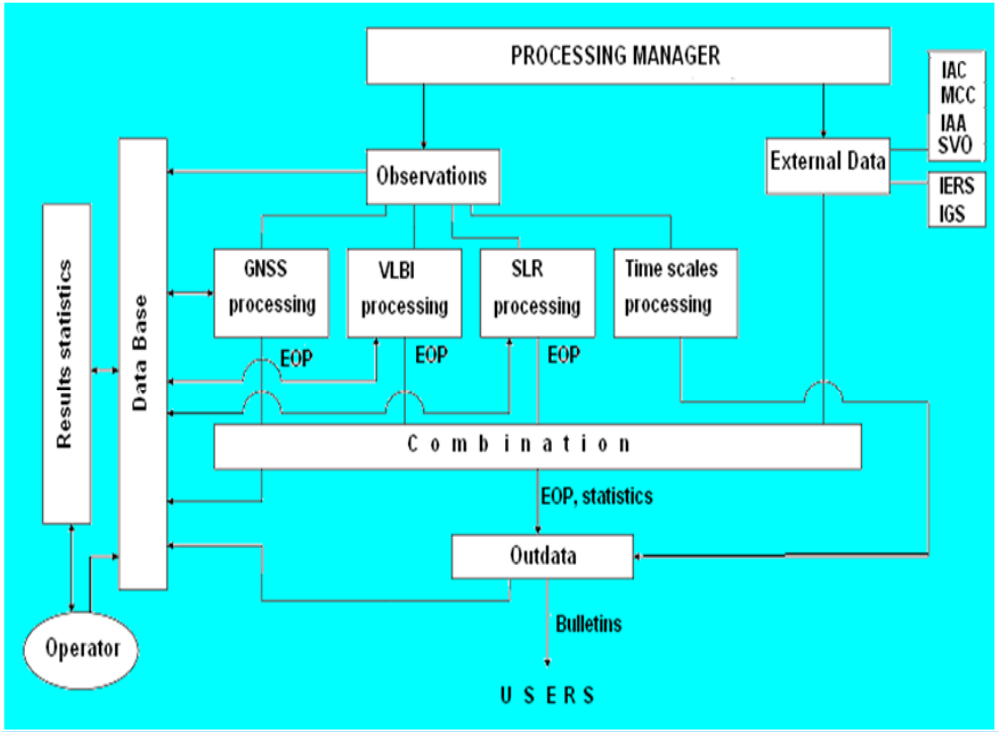
2011

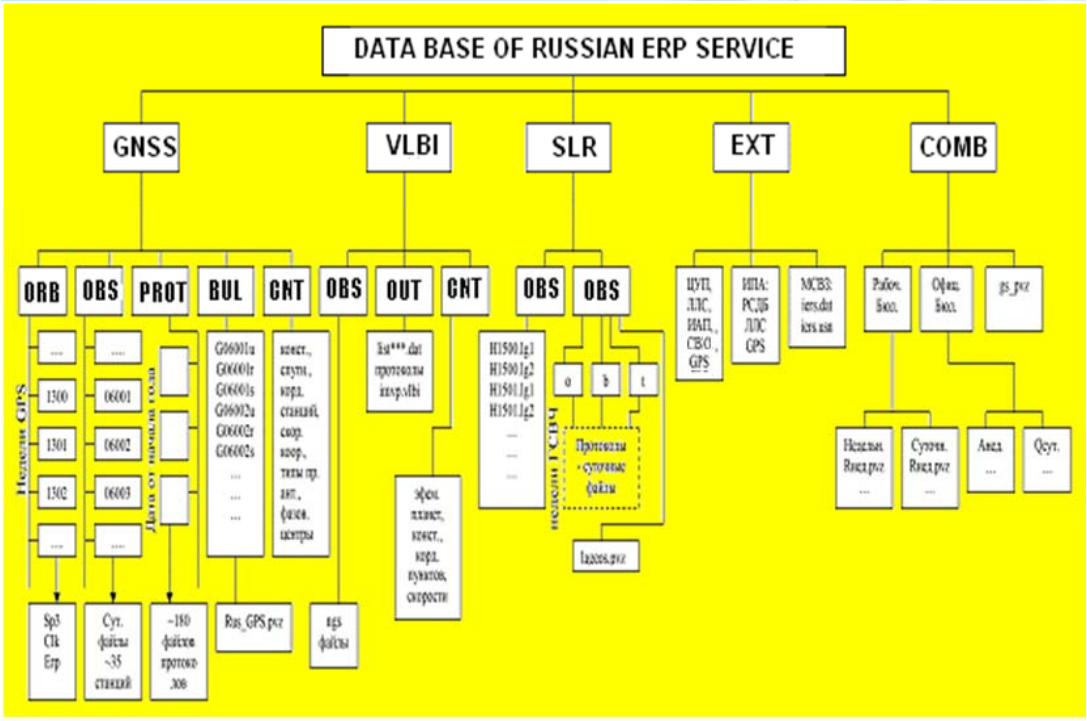
Now the 8 independent series are used for EOP combination

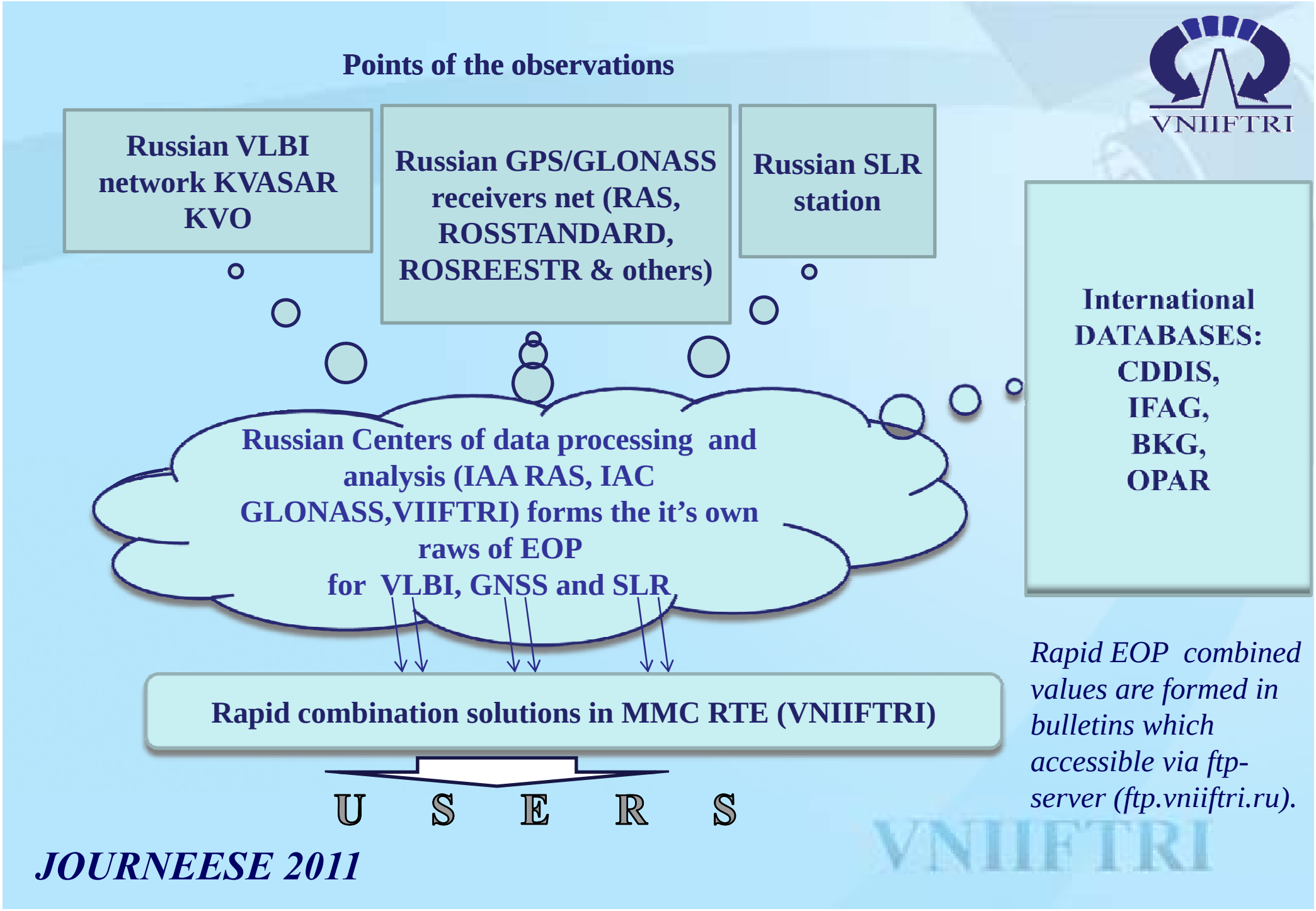
Separate series which are used for combination in 2013

	Analysis centers of Russian EOP PC	Observation technics	Values
1	MMC NSTF (VNIIFTRI)	GPS	*X, Y, UT1*
2	MMC NSTF (VNIIFTRI)	VLBI	*X, Y, UT1, dy, de*
3	IAA RAS	SLR	*X, Y, UT1*
4	IAA RAS	GPS	*X, Y, UT1*
5	IAA RAS	VLBI	*X, Y, UT1, dψ, dε*
6	SVOEVP (from 1.07.13)	GPS/GLONASS	*X, Y, UT1*
7	MCC RSA	SLR	*X, Y*
8	IAC RSA	GPS	*X, Y*

It is used method of combination which was developed and implemented by Kaufman Mark Borisovich in 2006



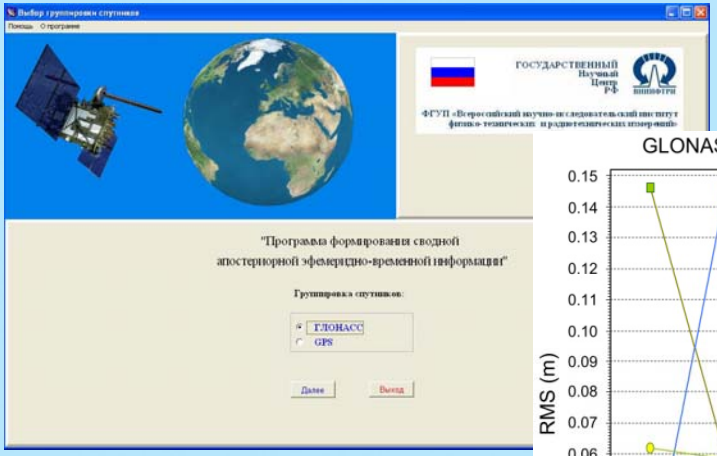


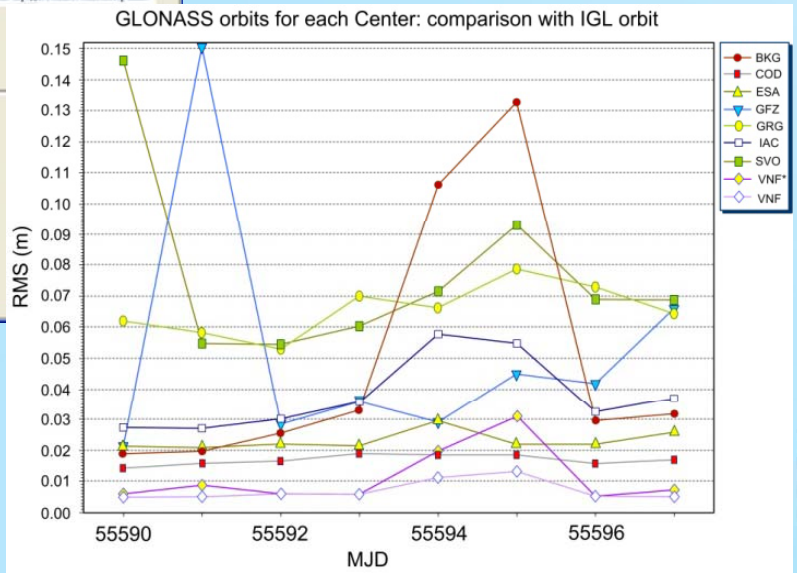

Points of the observations
Russian VLBI network KVASAR KVO
Russian GPS/GLONASS receivers net (RAS, ROSSTANDARD, ROSREESTR & others)
Russian SLR station
International DATABASES: CDDIS, IFAG, BKG, OPAR
Russian Centers of data processing and analysis (IAA RAS, IAC GLONASS,VIIFTRI) forms the it's own raws of EOP for VLBI, GNSS and SLR
Rapid combination solutions in MMC RTE (VNIIFTRI)
U S E R S
Rapid EOP combined values are formed in bulletins which accessible via ftp-server (ftp.vniiftri.ru).
VNIIFTRI
JOURNEESE 2011

3) Combination of GLONASS satellites orbit/clock

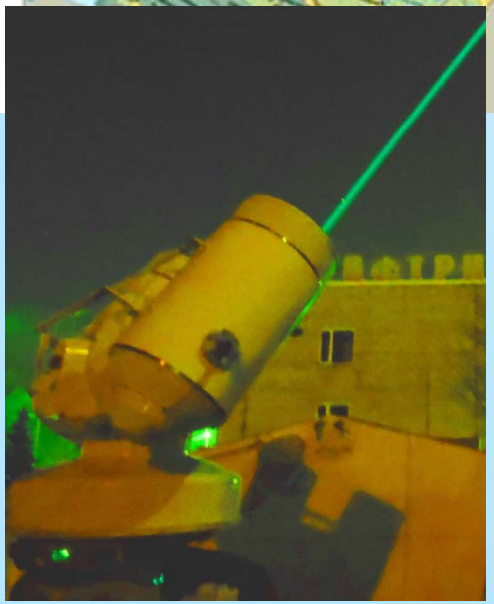
An algorithm and a program for GLONASS satellites orbits combination were developed. The calculations by this program as well as calculations of the coordinate differences for GNSS antennas in VNIIFTRI (Mendeleevo, Moscow reg.) and the North-Eastern branch of VNIIFTRI (Irkutsk) using different orbits and clock corrections are provided. Some theoretical estimates for RMS in satellites coordinate reference values determination were derived. It is shown that under condition when RMSs in satellite coordinates estimation provided by separate Analytic Centers during a long time interval are commensurable the RMS of reference values is no greater than RMS of satellite coordinates estimated by any of the Analytic Centers.

4.1. Bezmenov I., Pasynok S. GLONASS orbit/clock combination in VNIIFTRI (Poster session, Journees 2014)





4) Providing GNSS and SLR observations at five metrological sites acting under the auspices of Federal Agency on Technical Regulating of Metrology(ROSSTANDART).



The results of GNSS observations are accumulated in VNIIFTRI in hourly mode and are used for rapid EOP evaluation.

The direct results of SLR observations are transferred into IAC RSA and further in ILRS.

Thanks for your attention!