EOP determination from observations of Russian VLBI-network «QUASAR»

A.Finkelstein, A.Ipatov, S. Smolentsev, A.Salnikov, I.Surkis,
I. Gayazov, E. Skurikhina, S.Kurdubov,
I.Rahimov, A.Dyakov, R.Sergeev, V.Shpilevsky

Institute of Applied Astronomy RAS

7th IVS General Meeting
"Launching the Next-Generation IVS Network"
Madrid (Spain), March 4-9 2012

«QUASAR» NETWORK
2015×4282×4405 км

Центр корреляционной обработки ,
Санкт-Петербург

Обсерватория «Светлое»,
Ленинградская область

Обсерватория «Зеленчукская»,
Карачаево-Черкесская Республика

Обсерватория «Бадары»,
Республика Бурятия

“There is no national science, as there is no national multiplication table.”
(Anton Chekhov)

This work is of very importance for:

- GLONASS support
- contribution to station positions appointment
- contribution to sources posinions monitoring for ICRF
- contribution to IVS EOP time series for densification

“QUASAR” COMPLEX COMPONENTS:

- Three observatories:
  «Svetloe», «Zelenchukskaya», «Badary»
- IAA correlator center (schedule, correlation data treatment)
- IAA technical Consulate – obs. plan for year, month
- IAA technology center
- IAA AC

STATIONS EQUIPMENT

Svetloe
operable :1999,
IVS obs:2003,
QUASARobs:2006

Zelenchukskaya
operable :2001,
IVS obs: 2005 (end),
QUASAR-obs: 2006

Badary
operable :2005,
IVS obs:2007,
QUASAR-obs : 2006

- 32 m radio telescope, equipped with low noise receivers,
- frequency and time keeping system with H-masers (VCH-1003M),
- local geodetic network,
- control computers, local computer
- recording terminals Mark5B+,
- DAS R1002M (digital back end)

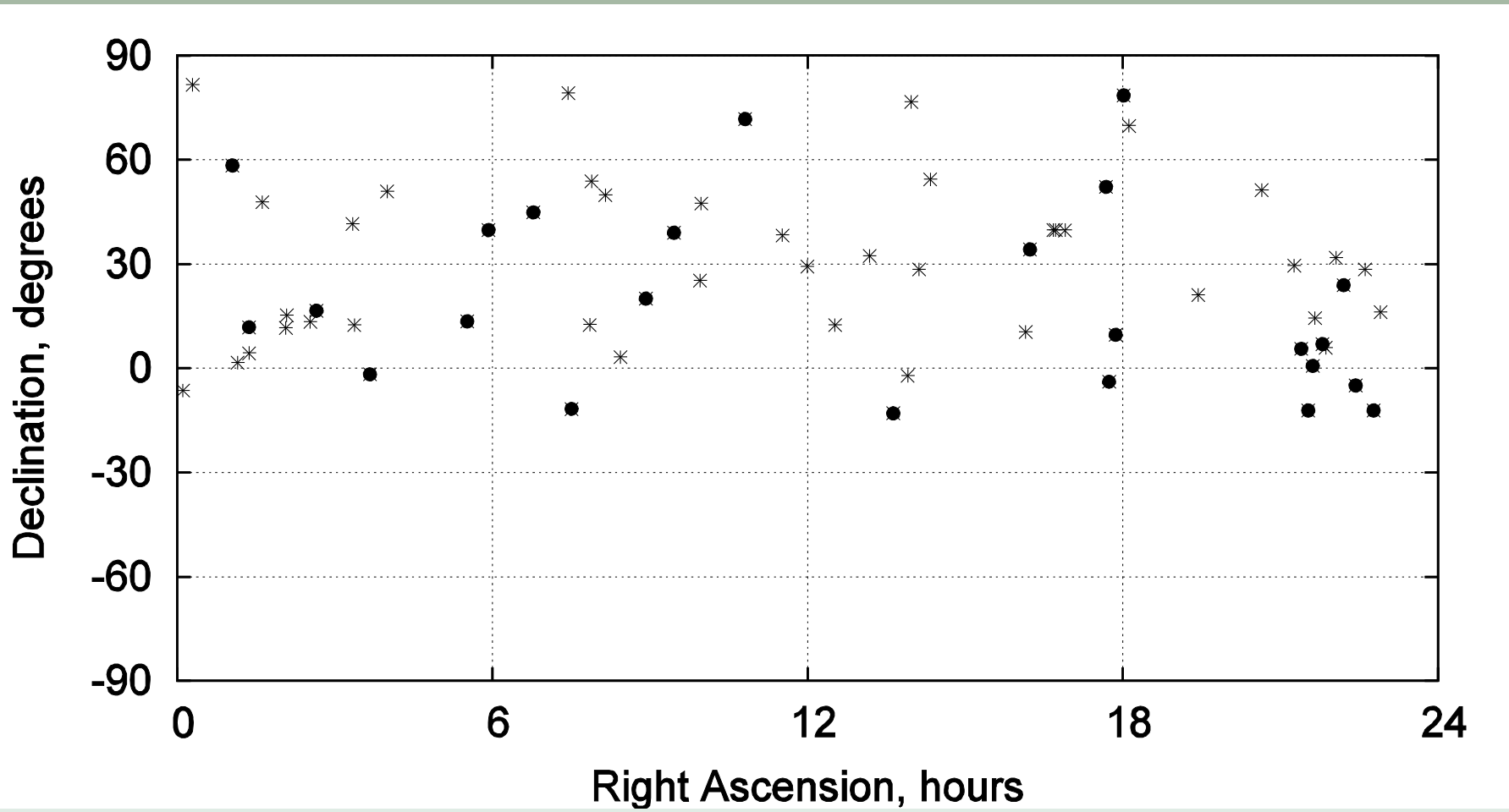
DOMESTIC VLBI PROGRAMS

	Ru-U	Ru-E
stations	Bd Zc(Sv)	BdZcSv
Duration, hours	1	24
aim	dUT1	EOP (Xp, Yp, dUT1, Xc,Yc)
Turn-around time	2 hours	2-5 days
Data transfer	e-vlbi	shipping
Frequency, start time	weekly, Friday 20 UT	weekly, Friday 22UT
scheduling	SKED (IAA), X/S, 1min 159 sources, > 0.25 J	SKED (IAA), X/S, 1min 63 sources, > 0.5 J
bandwidth	8 MGz	16 MGz
Data sampling	1 bit	1 bit
Data rate	256 Mb/s	512 Mb/c
Number of scans	20	330-350
Number of obs.	20	~1000

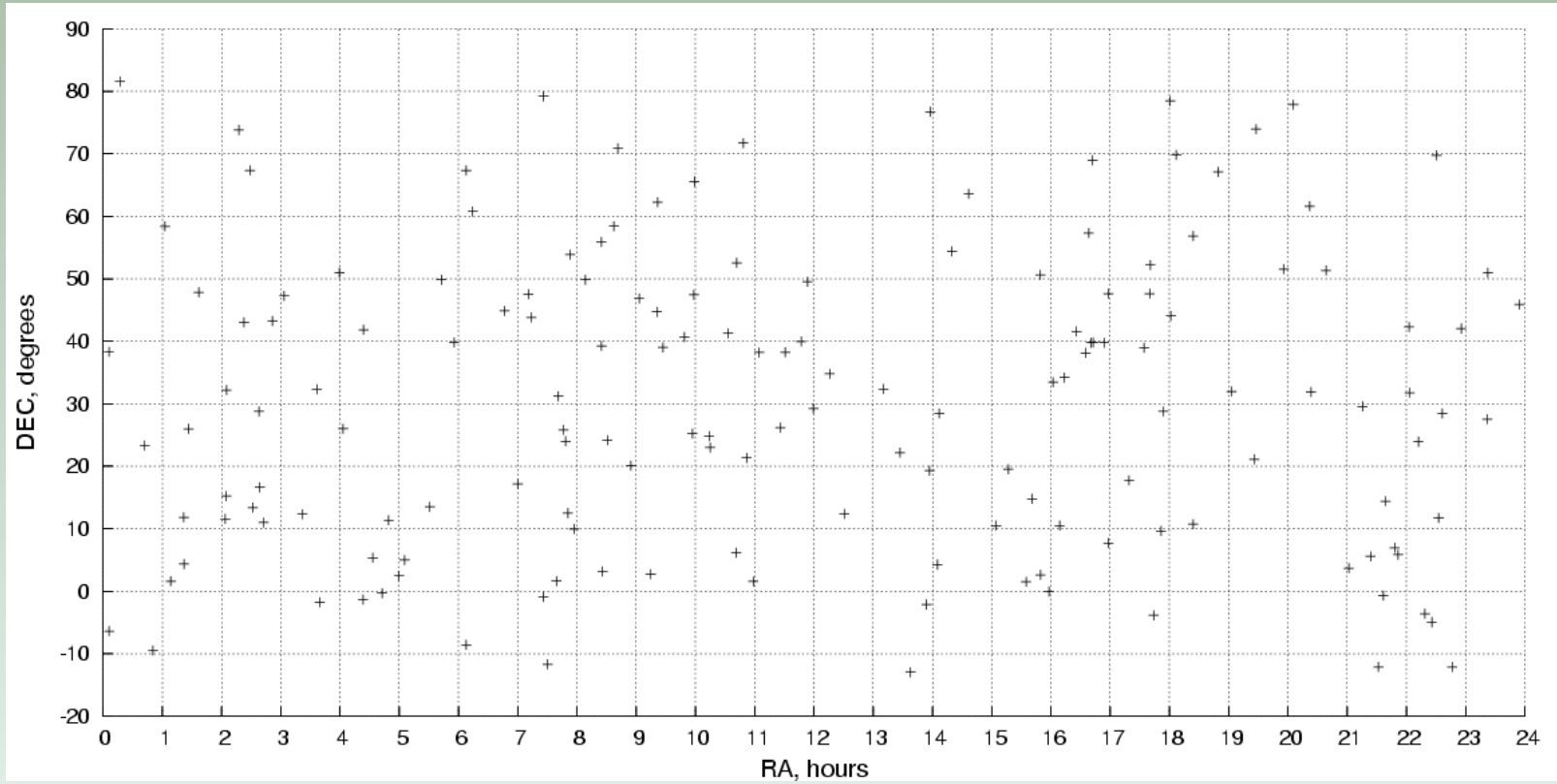
DOMESTIC SESSIONS

	Ru-U			Ru-E		
	Sv	Zc	Bd	Sv	Zc	Bd
2006		6	6	9	9	9
2007	10	12	17	9	9	9
2008	18	15	18	14	14	14
2009	13	26	30	23	23	23
2010	3	50	50	20	20	20
2011	5	65	65	49	49	49
2012	51(1)	51(8)	51(7)	51(5)	51(5)	51(5)

new radio sources set Ru-E (63 sources, > 0.5 J)



new radio sources set Ru-U (159 sources, > 0.25 J)



The main steps at the development Russian Domestic VLBI observations:

- 2005 first VLBI experiments on X-band, ionosferic delay account - from TEC.
- Since Auguest 2006 - start regular QUASAR network observations, biweekly with S2 registrator, MicroPARSEC 3-station correlator
- 2009 - Mark5b since February, weekly observations - first attempts were made, ARC correlator Mark5B
- April 2009: first e-vlbi experiment, since September 2009 - e-vlbi data transfer on regular base for 1-hour Ru-U sessions. Weekly Ru-E and Ru-U sessions on regular base since July 2010 (after Svetloe repair works).
- New DAS - first experiment (May 2011), IVS-R4 sess.
- Oct.2011 DAS P1002M – Sv, Bd, Zc
- Since Nov. 2011 – observations with “RadioAstron”

IAA correlator ARC

- 2006-2008
  3-station IAA correlator
  MicroPARSEC , S2

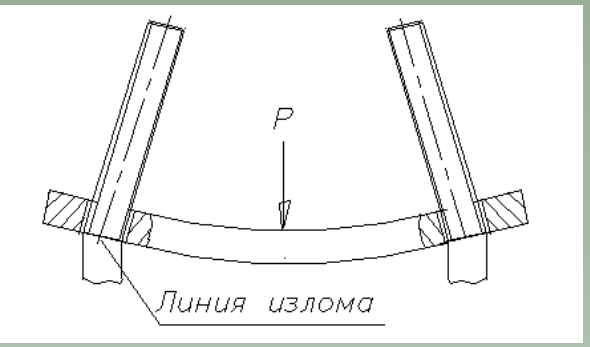
- 2009
  2 st. Correlator IAA
  ARC, Mark5B

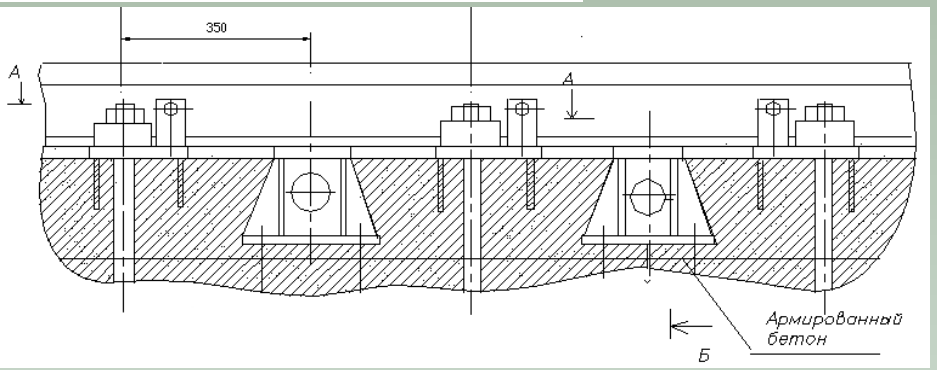
- 2010: 6-station
  correlator IAA ARC

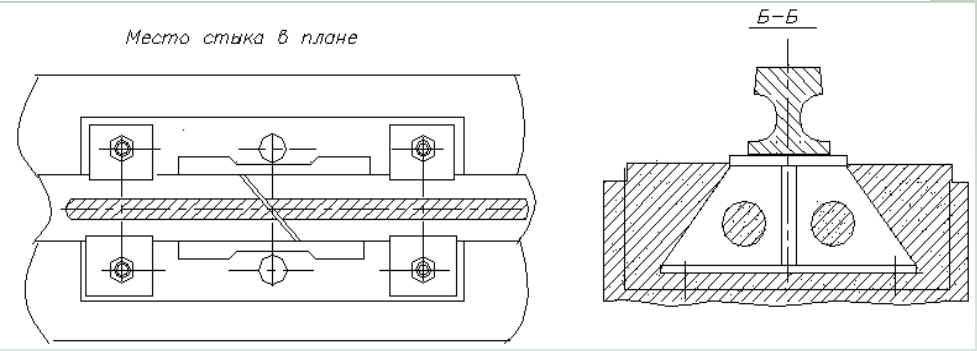
Svetloe: 2006: reconstruction

1. rail reconstruction

Sv: 2006, **Zc, Bd – 2007**







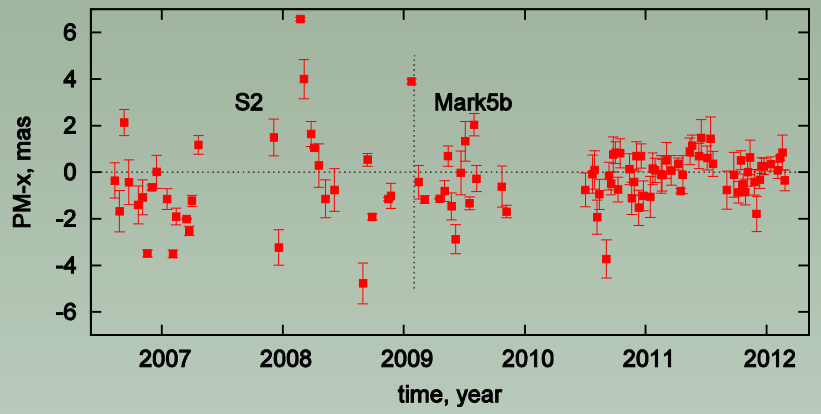
The antenna rail was reconstructed by adding a steel supporting construction and rebuilding the concrete under it.

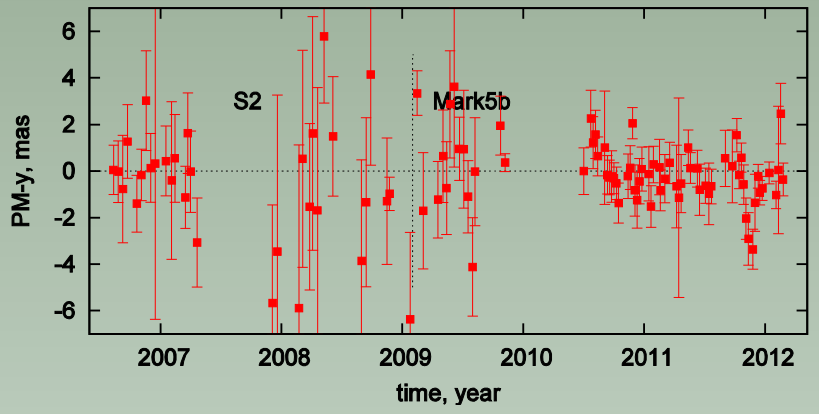
Nov.2009 – Jun. 2010 – SVETLOE no operable
antenna repair works for steel construction suppporting,
summer 2010 – prophylactic works for Badary, Zelenchukskaya

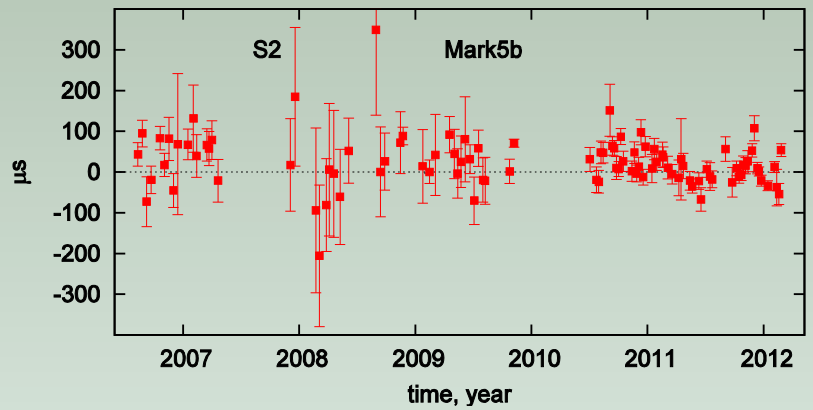
VLBI data analysis

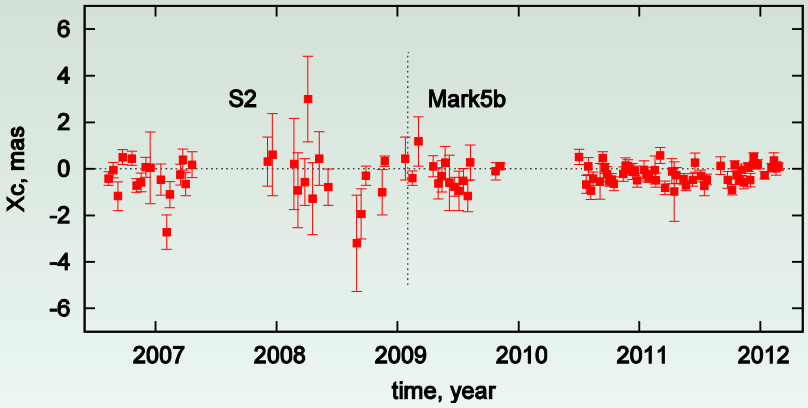
- QUASAR software
- OCCAM/GROSS (for results verification)
- Reduction – IERS Conventions
- catalogues: from QUASAR global solution
- standard parametrization
- tropospheric gradients are not estimated
- Ru-U sessions - in automatic mode

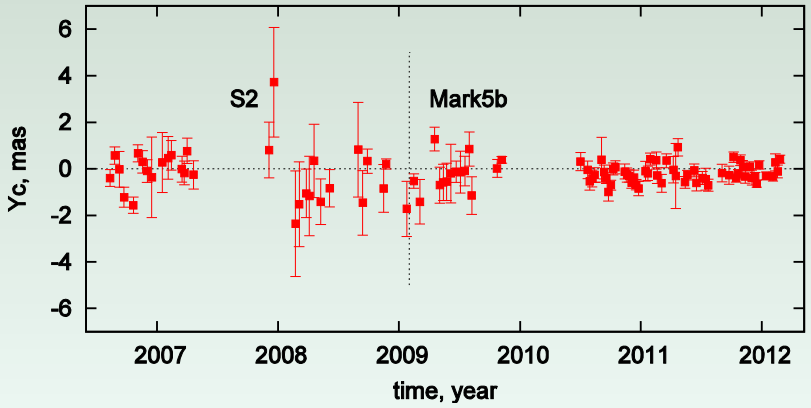
RuE-IERS 08 C04



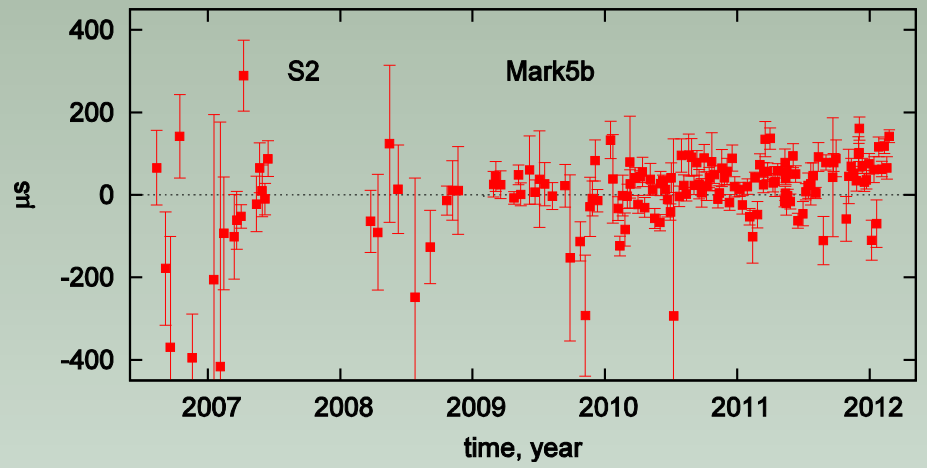




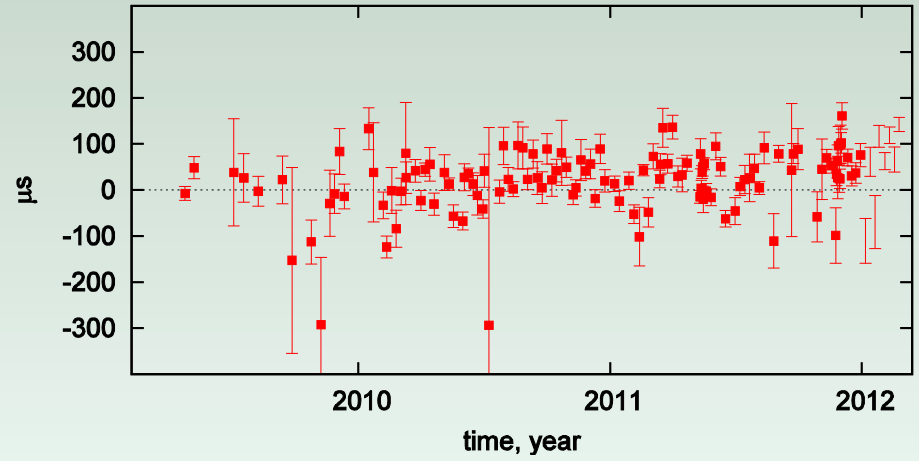




Ru-U-IERS 08 C04



e-vlbi



TEST FOR EOP ACCURACY COMPARISON

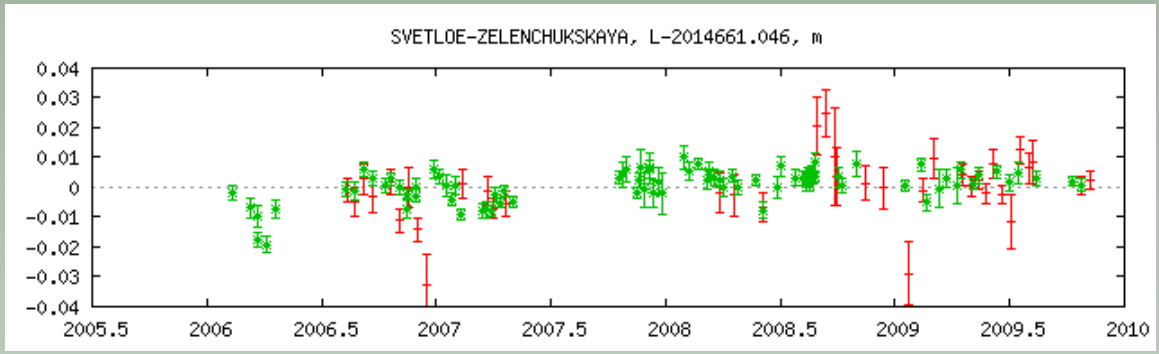
For Ru-E, we extract observations for BdSvZc from IVS-R4 sessions

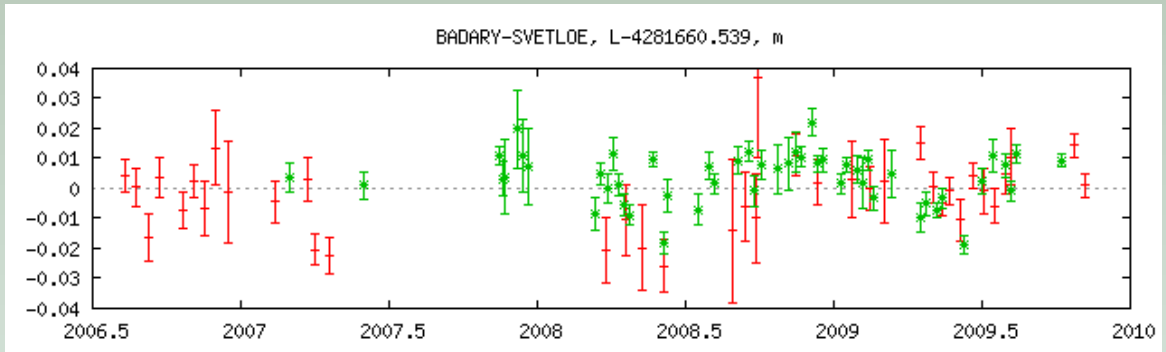
For Ru-U comparison we used IVS-Int2 sessions for 2011 WzTs

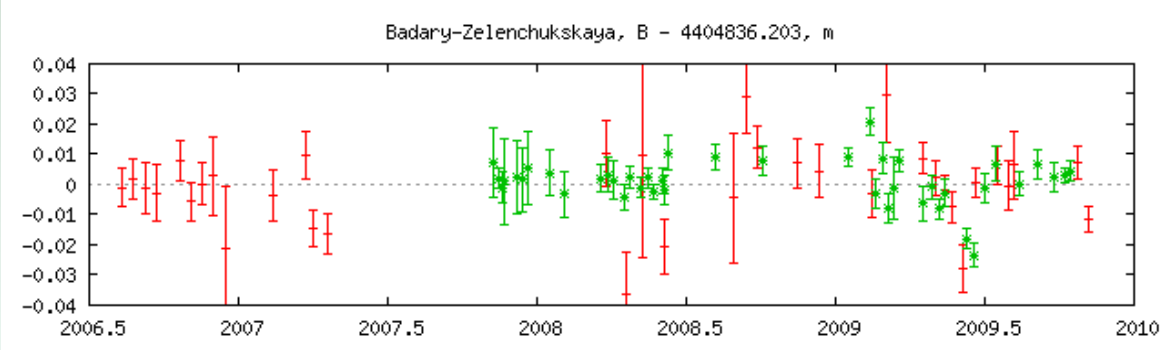
EOP time series accuracy
(rms (EOP(IAA) – IERS 08 C04))

	Domestic sessions		**IVS-R4 (SvZcBd)**	
	N sessions 2011.2-2012.2	rms	N sessions 2007-2011	rms
dUT1, Int, μs	53	59	125	37
Xp, mas	30	0.72	34	0.73
Yp, mas	30	1.13	34	1.13
dUt, μs	30	35	34	37
Xc, mas	30	0.41	34	0.29
Yc, mas	30	0.39	34	0.34

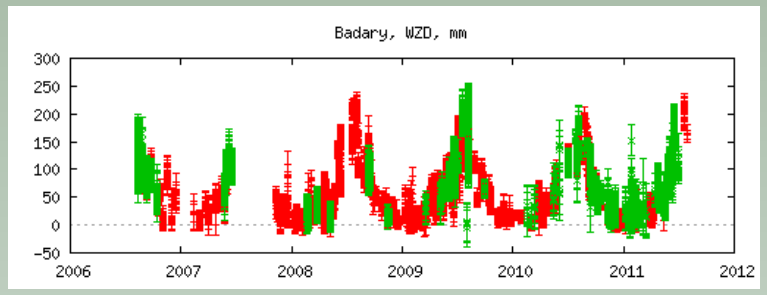
TIME SERIES OF BASELINES LENGTH

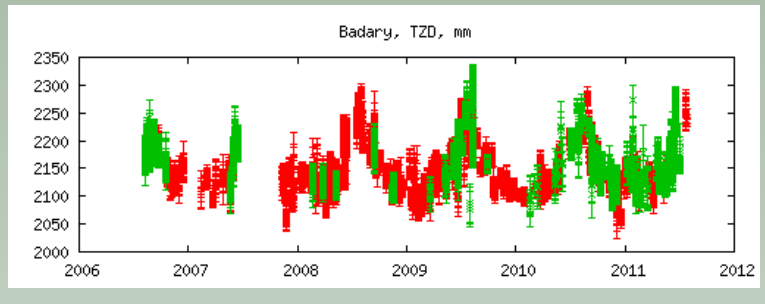


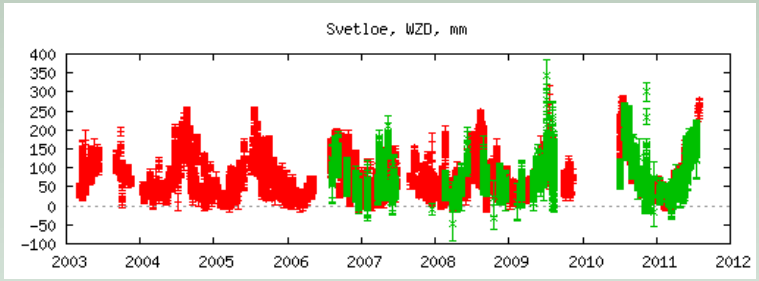


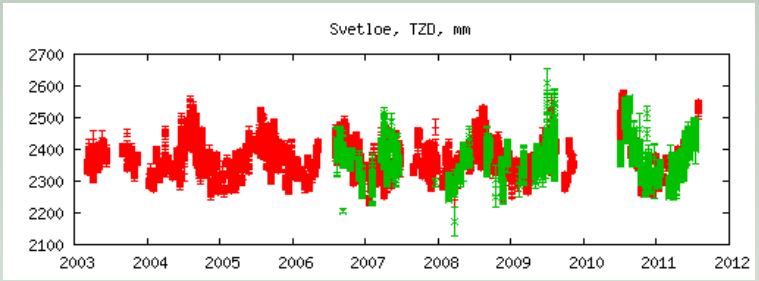


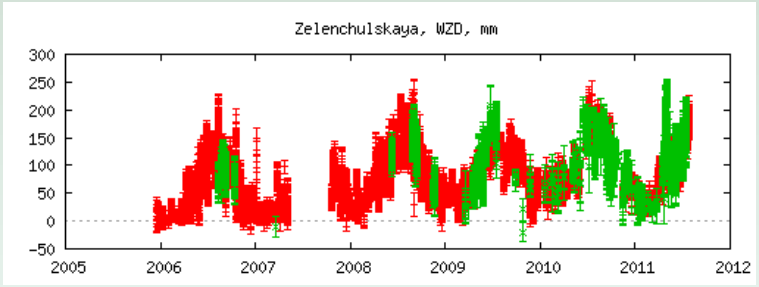
TROPOSPHERIC PARAMETERS WZD, TZD

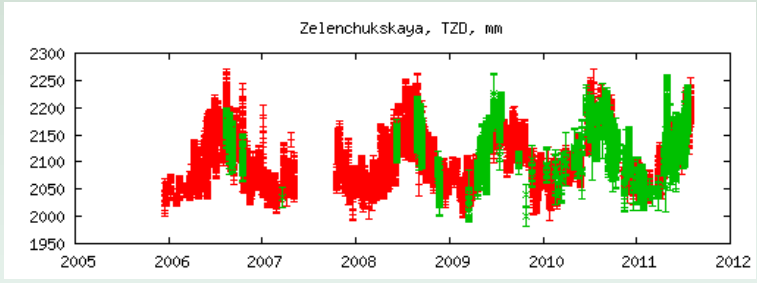












CONCLUSION REMARKS

- Problem: ~ only 70% observations

correlated (? – SNR filtering, source set, other reasons – under investigation) – possible reserve for EOP accuracy improving

- Further improvements:
  - software correlator
  - WVR
  - 2010 VLBI antennas (Zelenchukskaya, Badary)
- Colocation with GNSS, SLR (see poster)

THANK YOU!