

International VLBI Service for Geodesy and Astrometry

- Product Generation and Future -

Axel Nothnagel

- IVS Analysis Coordinator -

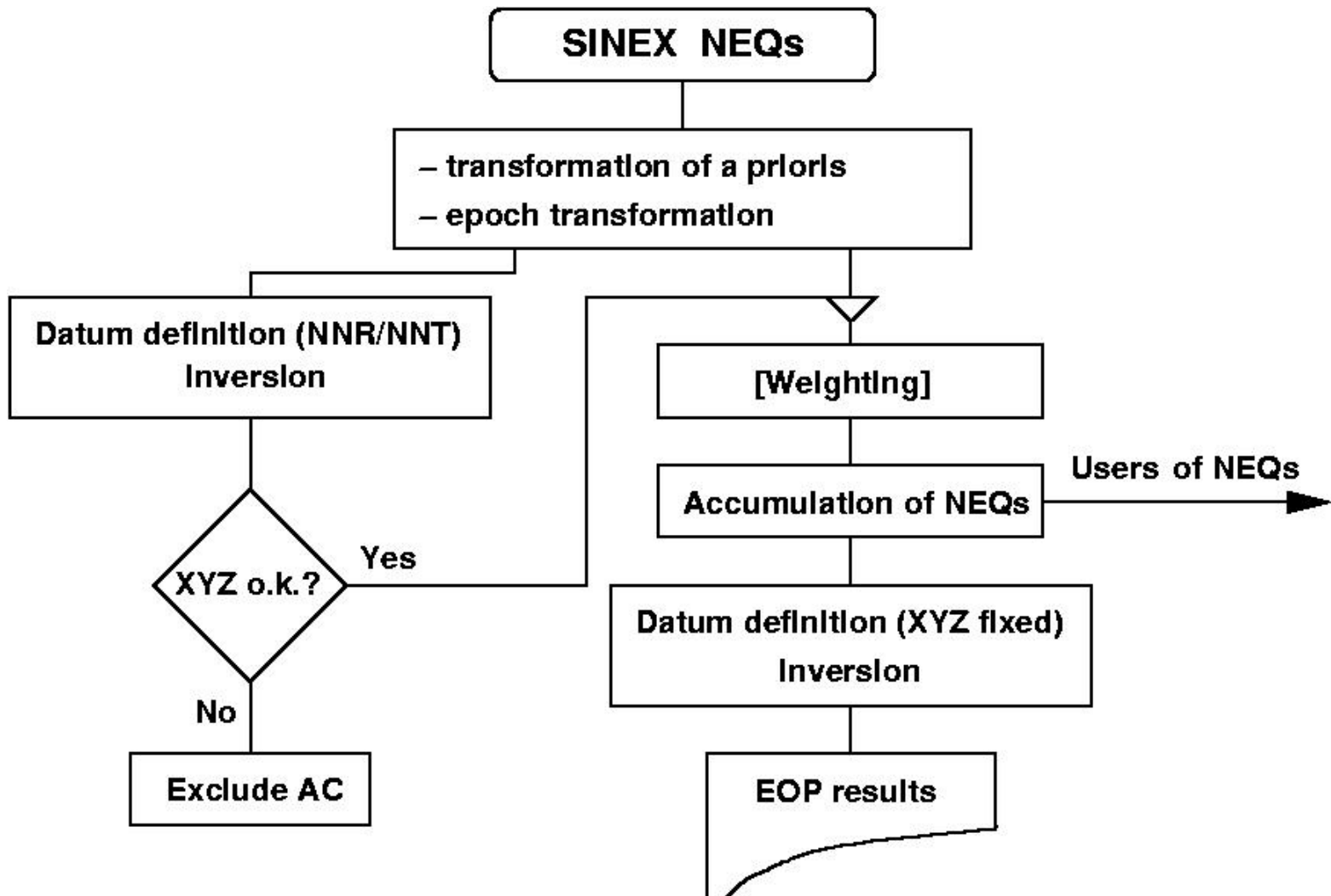
Institute of Geodesy and Geoinformation

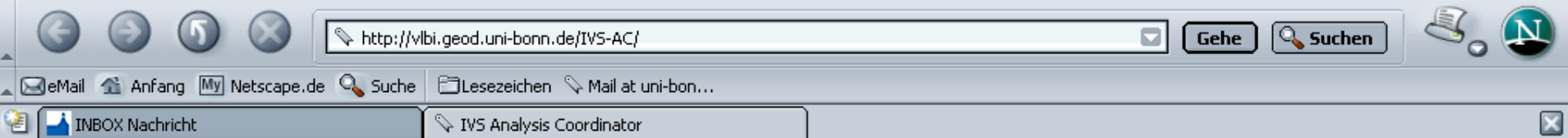
University of Bonn

- Current status
 - bookkeeping
 - EOP combinations
 - Deficiencies and problems
- Future plans
- Needs
- Common Research Projects

- Observables
 - Group delays
 - On-site temperature, pressure, humidity
 - System delay calibration
- Standards and models
 - IERS standards (not compulsory)
 - IVS telescope dimension tables (axis offsets)
tables for thermal expansion exist, reference temp missing
- Parametrization and strategies
 - Non-uniform (LSQ, filter, ...)
 - Core-ACs: pre-reduced NEQs for site coord. and EOP

- Combination of SINEX files for EOP determinations





IVS Analysis Coordinator

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EOP Products

- ♦ IVS **Primary** Combined EOP results on the basis of SINEX normal equations
[Quarterly Solution](#)
 - ◊ all available sessions from 1984 - now
 - ◊ updated every three months
 - ◊ referenced to ITRF2005
 - ◊ Epoch: middle of session

[Rapid Solution](#)

- ◊ all R1- and R4-sessions from 2005 - now
- ◊ updated twice a week
- ◊ referenced to ITRF2005
- ◊ Epoch: middle of session
- ♦ Comparisons of EOP results
 - ◊ by [Observatoire de Paris](#)

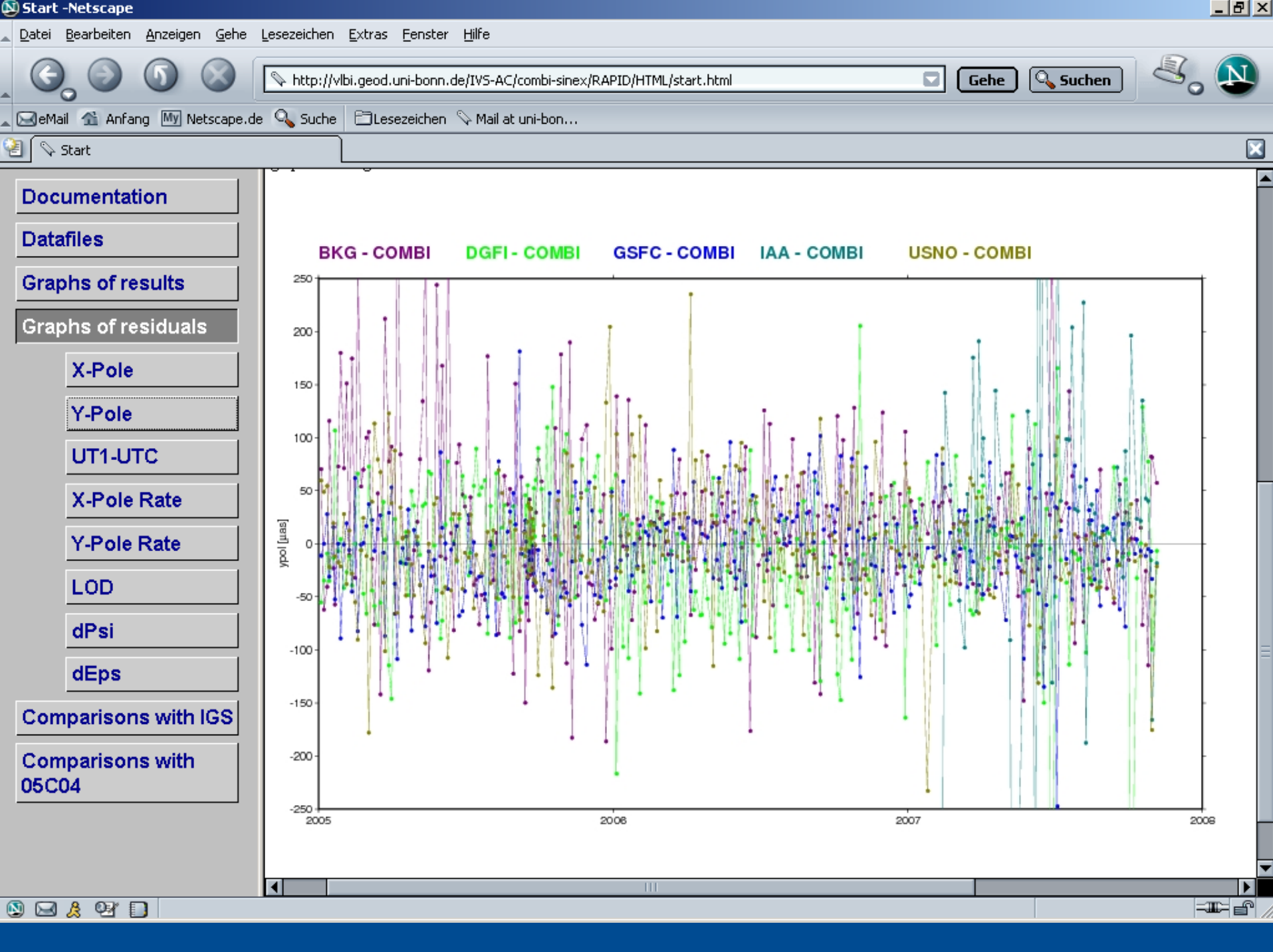
- ♦ IVS **Secondary** Combined EOP results on the basis of EOP time series
Quarterly Solutions
 - ◊ all available sessions from 1984.01.01 - 2006.12.01
 - ◊ updated every three months
 - ◊ referenced to ITRF2000
 - ◊ Epoch: [middle of session](#) / [midnight](#)

Rapid Solutions

- ◊ all available sessions from 2006.01.01 - 2007.02.02
- ◊ updated twice a week
- ◊ referenced to ITRF2000
- ◊ Epoch: [middle of session](#) / [midnight](#)

Other Products

- ♦ IVS VLBI [baseline lengths](#)



Y-Pole residuals

Statistics

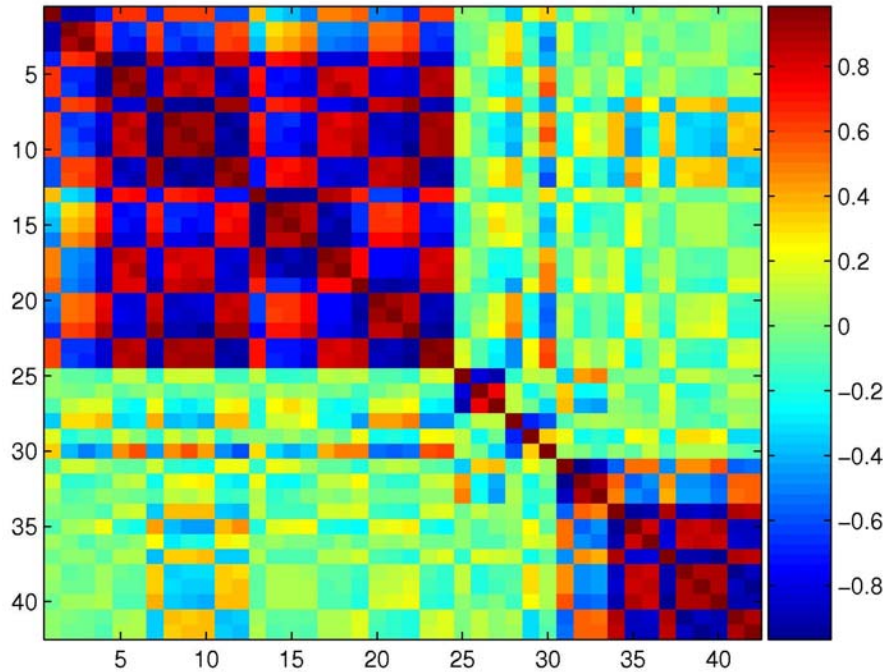
	BKG	DGFI	GSFC	IAA	USNO
	(01/2005 - now)	(01/2005 - now)	(01/2005 - now)	(02/2007 - now)	(01/2005 - now)
Offset [μas]	2.7 ± 3.3	-4.9 ± 2.6	-3.2 ± 2.0	12.3 ± 15.3	1.1 ± 2.4
WRMS [μas]	56.2	44.3	34.7	117.8	40.5

Y-Pole residuals w.r.t IGS

Statistics

	BKG	DGFI	GSFC	IAA	USNO	COMBI
	(01/2005 - now)	(01/2005 - now)	(01/2005 - now)	(02/2007 - now)	(01/2005 - now)	(01/2005 - now)
Offset [μas]	62.2 ± 8.0	49.0 ± 7.3	52.2 ± 7.7	102.4 ± 20.9	56.2 ± 8.0	52.3 ± 7.5
WRMS [μas]	138.0	124.4	130.7	159.4	133.5	130.1

- Observations
 - Gaps in observing sessions (non-continuous)
 - Gaps in on-site met data, uncalibrated sensors
 - Aging equipment
 - Odd session start times
 - TRF in Japan
- Analysis
 - Not all ACs produce NEQs
 - Divergence of modeling
 - Thermal expansion (no IERS reference temperature)
 - No IERS reference pressure for atm. Loading
 - Gravitational sag (under investigation at IGGB)
- Latency



Velocities & Positions

Shintotsukawa

Chichijima

Mizusawa

Kashima

Aira

Tsukuba

Gifu

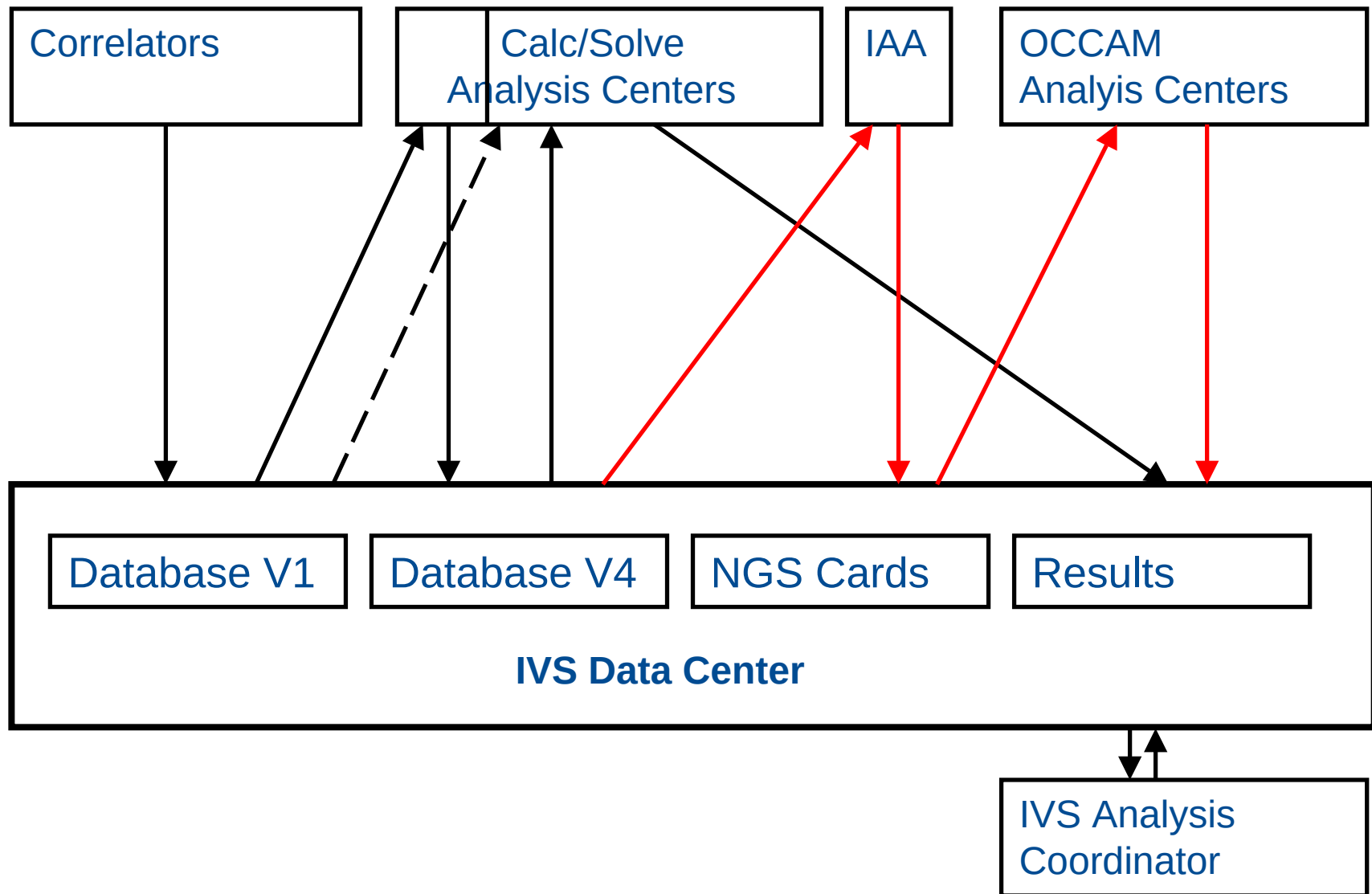
ITRF2005 deficits

- link to Japanese VLBI sites



Courtesy Barbara Meisel,
DGFI Annual Report 2005/2006

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2007 Nov 29					
2007 Nov 28			R1302 R4301 R1301		
2007 Nov 27					
2007 Nov 26					
2007 Nov 25					
2007 Nov 24 Sa					
2007 Nov 23					
2007 Nov 22					R4301
2007 Nov 21	R4301			R4301 R1301	
2007 Nov 20	R1301	R1301			R1301
2007 Nov 19					
2007 Nov 18					
2007 Nov 17 Sa					
2007 Nov 16					R1300
2007 Nov 15		R1300			
2007 Nov 14			R1300	R1300	
2007 Nov 13	R1300	R4300 R1299			
2007 Nov 12					
2007 Nov 11					
2007 Nov 10 Sa				R4300 R1299	R4300

Combination of Intensive UT1 sessions on SINEX basis

- SINEX files (datum-free normal equations) of Intensives contain

$X_1, Y_1, Z_1, X_2, Y_2, Z_2, UT1 - TAI, LOD, X_p, Y_p$

- Purpose
 - IVS combination with identical datum
 - Combination with IGS products

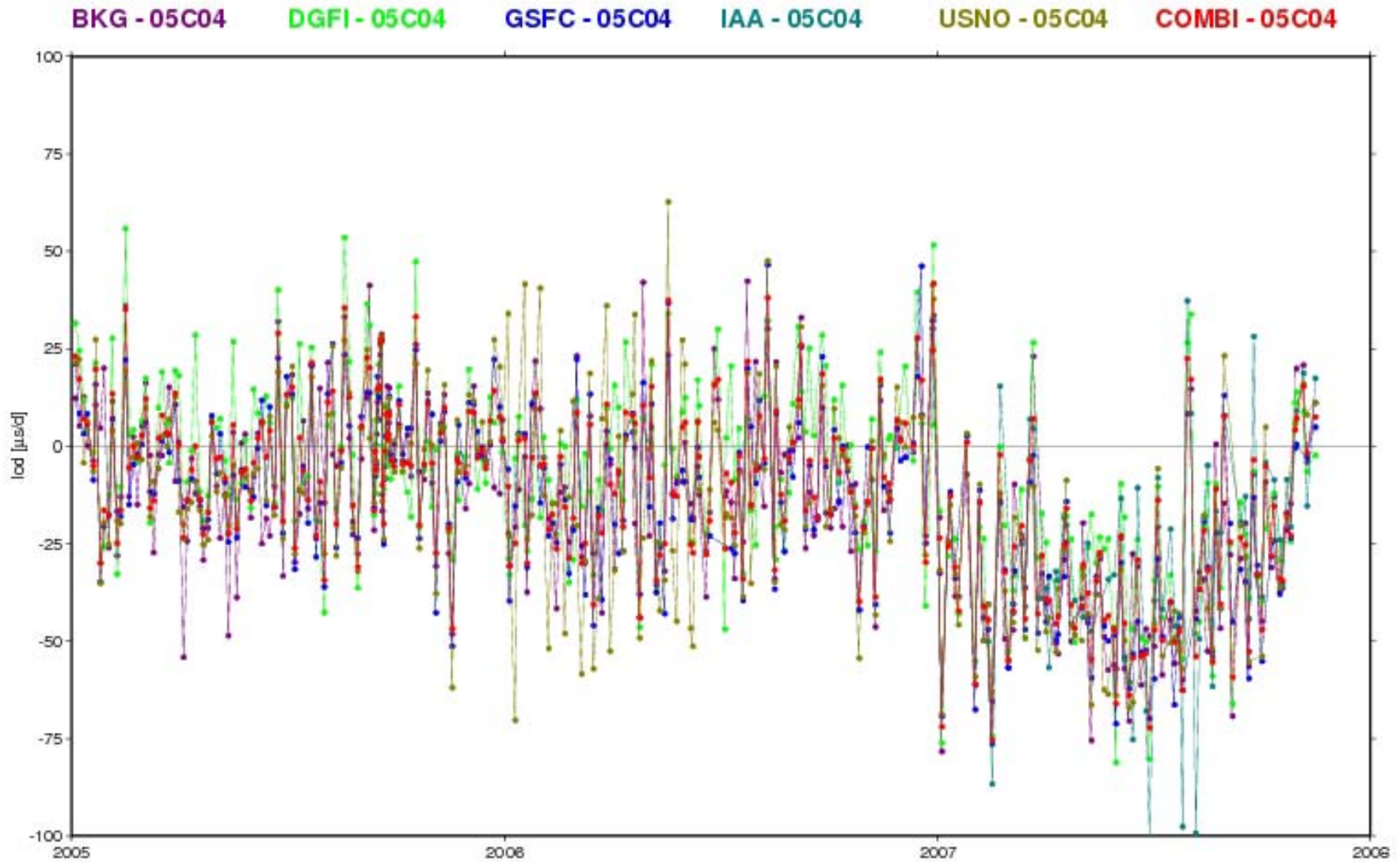
Extended SINEX files

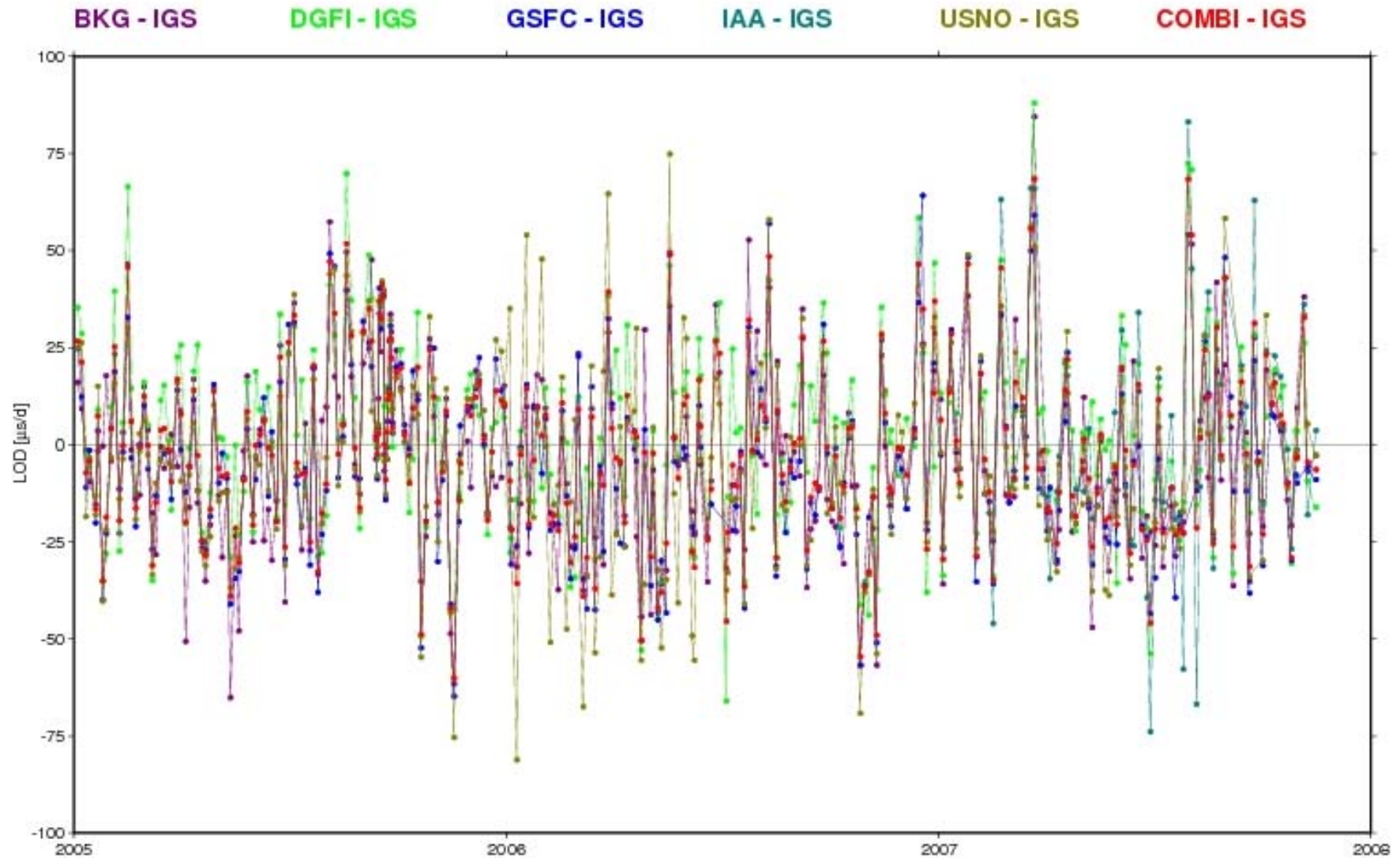
- NEQs with Parameters
(coefficients in datum free NEQ):
 - Station coordinates
 - X_p , X_p -rate, Y_p , Y_p -rate, UT1-UTC [TAI], LOD
(middle of session, i.e. at ~ 6.00 UT)
 - $d\psi$, $d\epsilon$ (IAU2000A) $\rightarrow$ X, Y (IAU2000A)
 - source positions
 - wet zenith delays (1 hourly),
continuous piece-wise linear
 - NS + EW gradients and their rates (at start and stop
epochs of 24 hr sessions)

- Electronic transfer of raw observing data
- Digital backends
- VLBI2010 (long term effect)



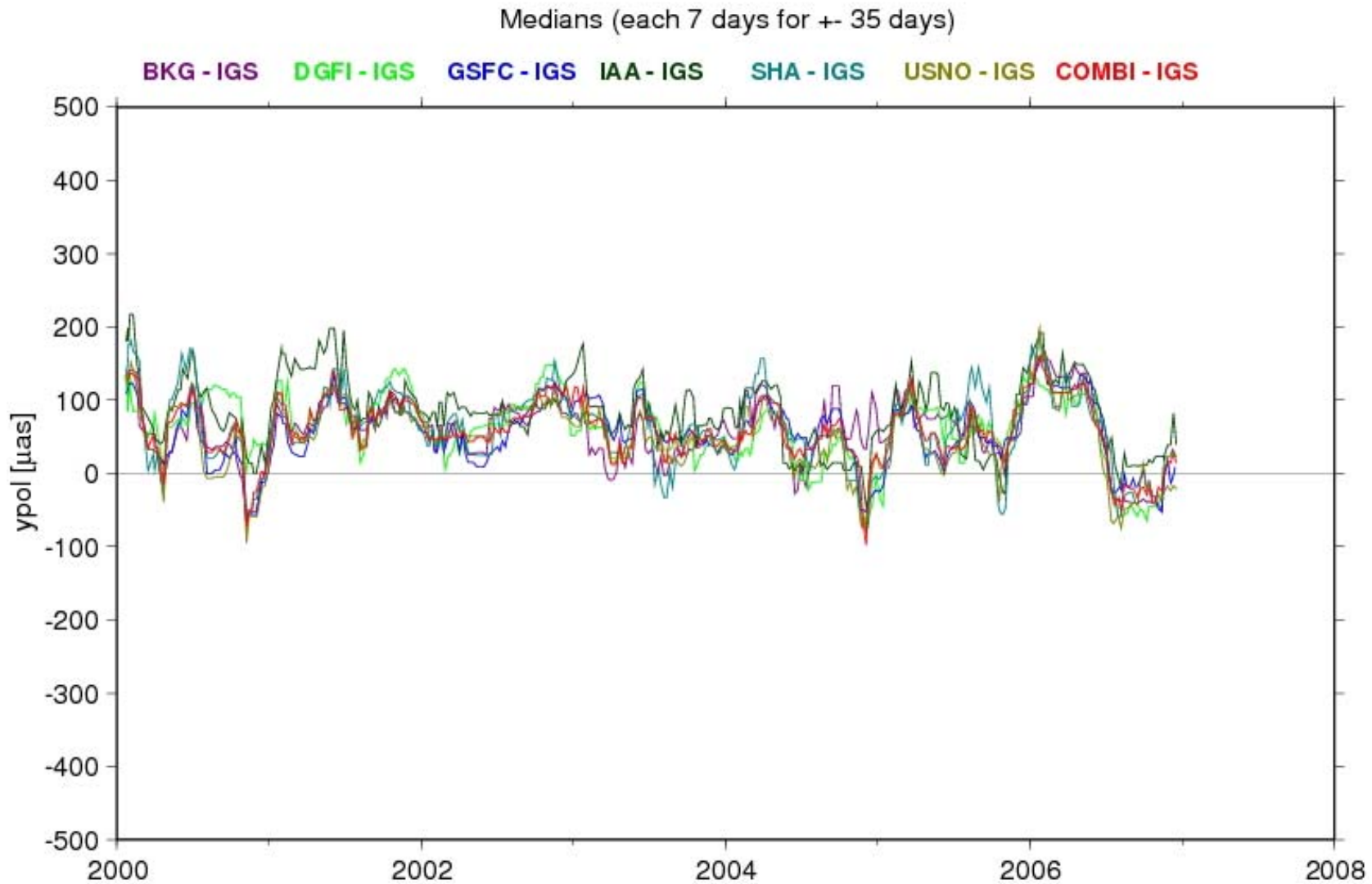
- More investigations in pre-delay process (IVS)
 - System calibration
 - fringe fitting
- Conscienceness of ACs for combination needs (IVS)
- improvement in latency (IVS)
- Decision on reference temp and pressure (IERS)
- More combination centers, e.g. for Intensives (IVS)
- Rigorous quality control (IERS)





Research projects with other space geodesy services

- Investigations of systematic EOP differences between techniques
- Combination of UT1 - TAI/LOD from VLBI Intensives and GNSS
- Combination of nutation from VLBI, GNSS and LLR
- Combination of atmospheric parameters from VLBI, GNSS and DORIS
- Monitoring of site coordinates



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