DGFI part of project PN 5
Status report

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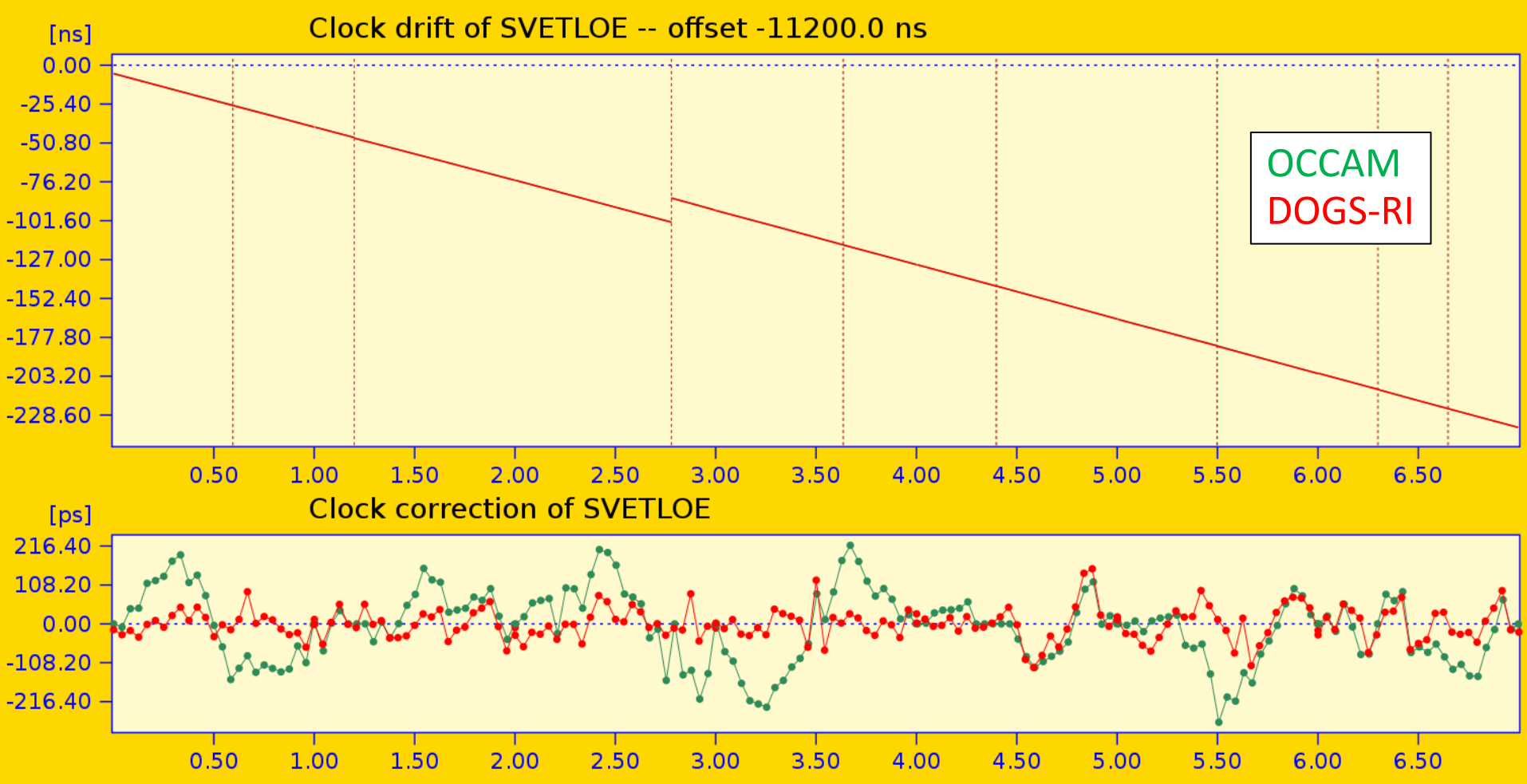
VLBI processing software DOGS-RI

- consistent with IERS 2010 Conventions
- (dX, dY) instead of ($d\psi$, $d\varepsilon$)
- correct relativistic calculation of partial derivatives w.r.t. parameters
- difference quotients replaced by time derivatives
- slightly different clock parameterization

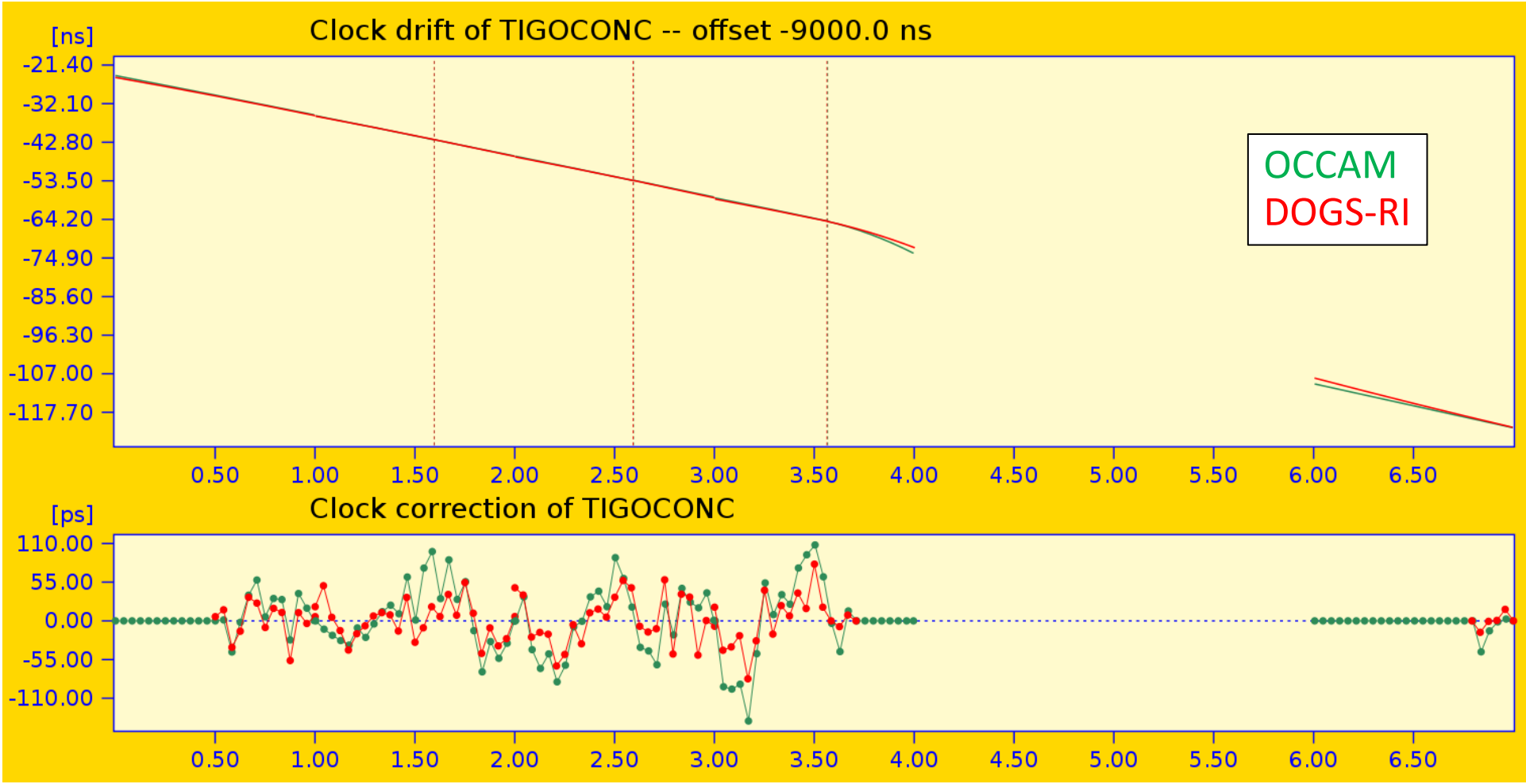
Comparisons shown on the following slides refer to the **first week** of the **CONT08 campaign**. For the session-wise solutions, the following parameters were set up: station and source coordinates, Earth orientation parameters, troposphere and clock corrections.

Clock parameterization (1)



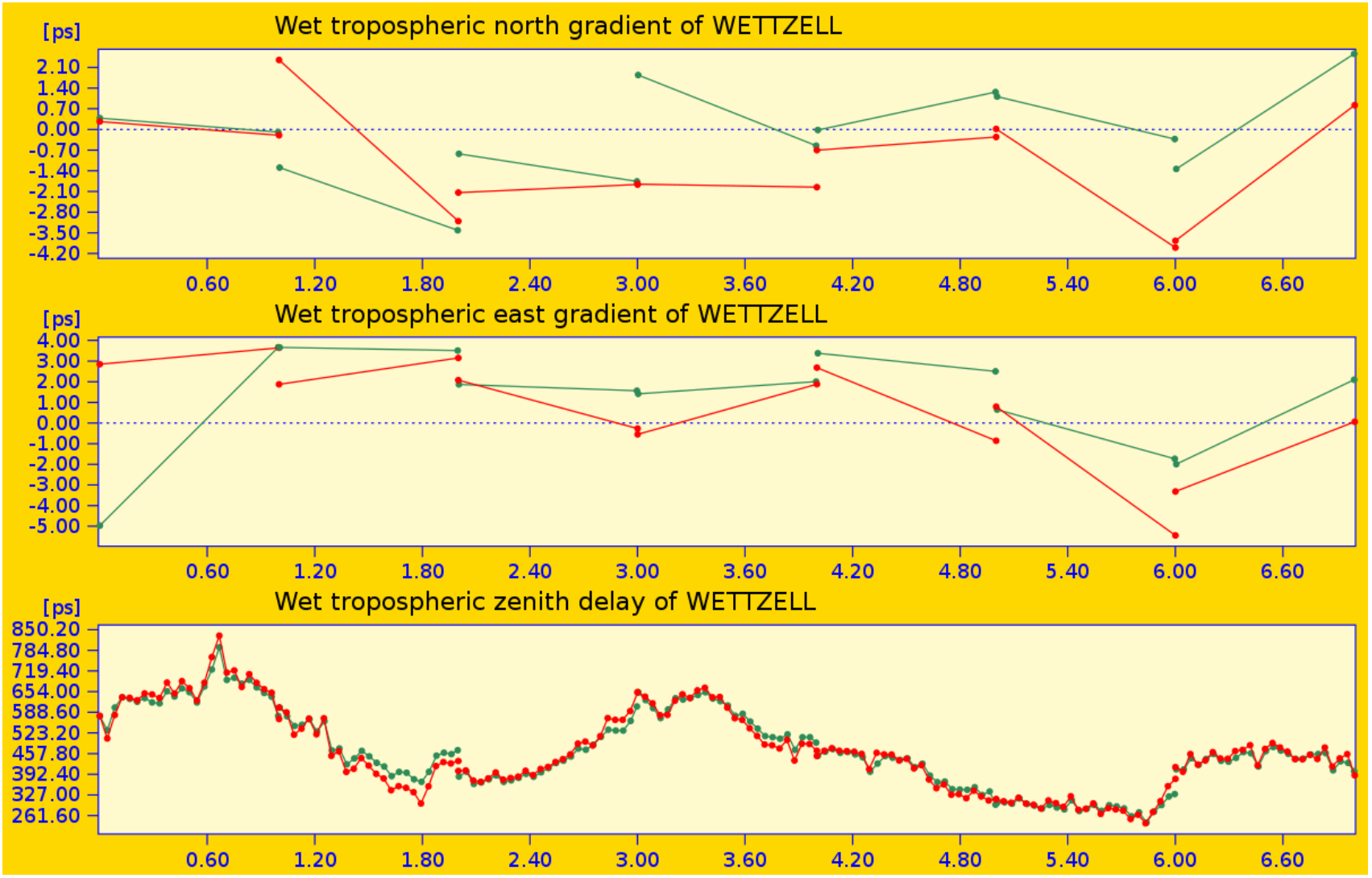
piecewise linear clock correction does no longer contain linear and/or quadratic terms (per day)

Clock parameterization (2)



piecewise linear clock parameters are only set up for intervals with observation data

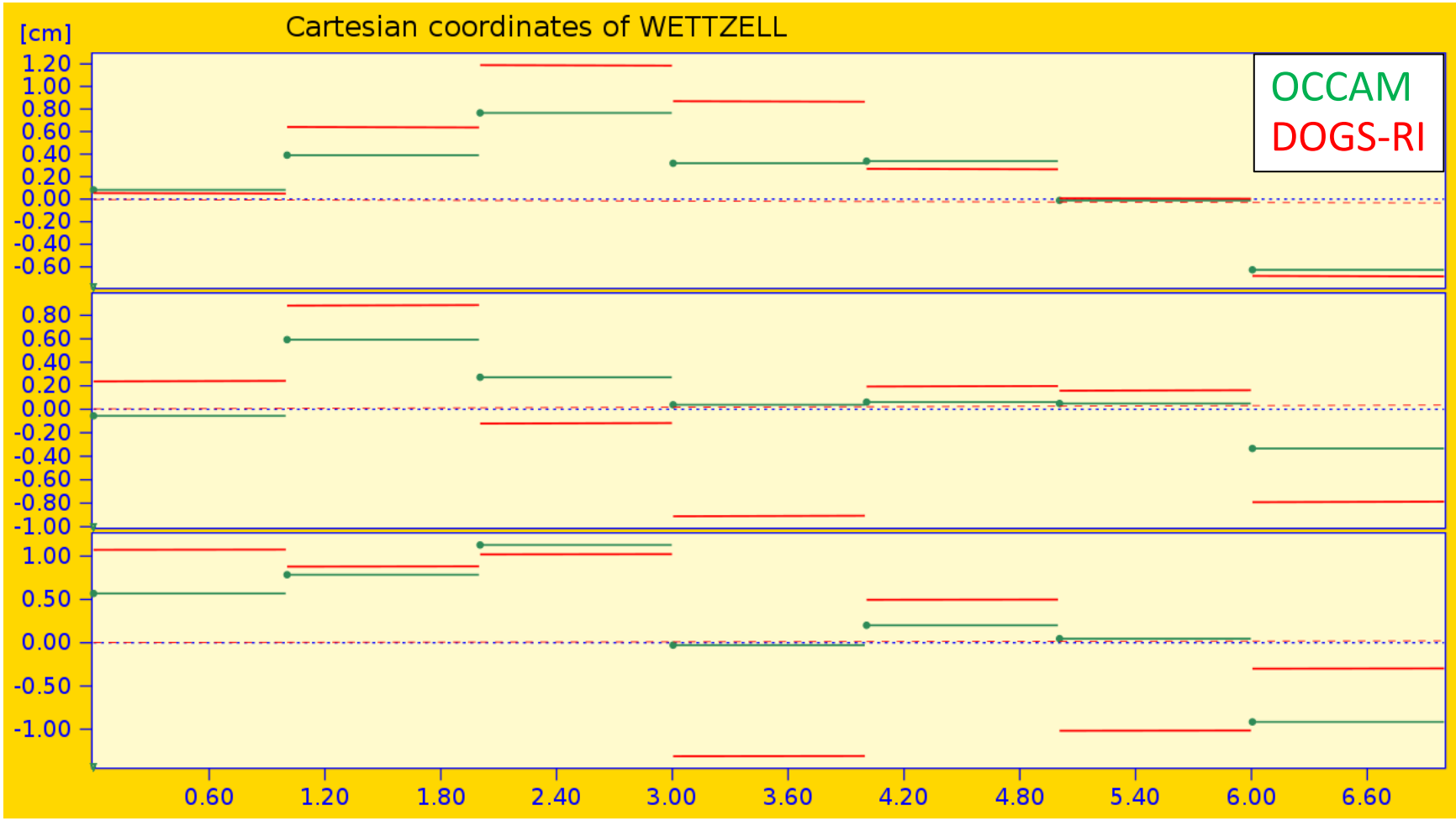
CONT08 troposphere parameters



OCCAM
DOGS-RI

smaller zenith delay jumps at day boundaries

CONT08 station coordinates (1)

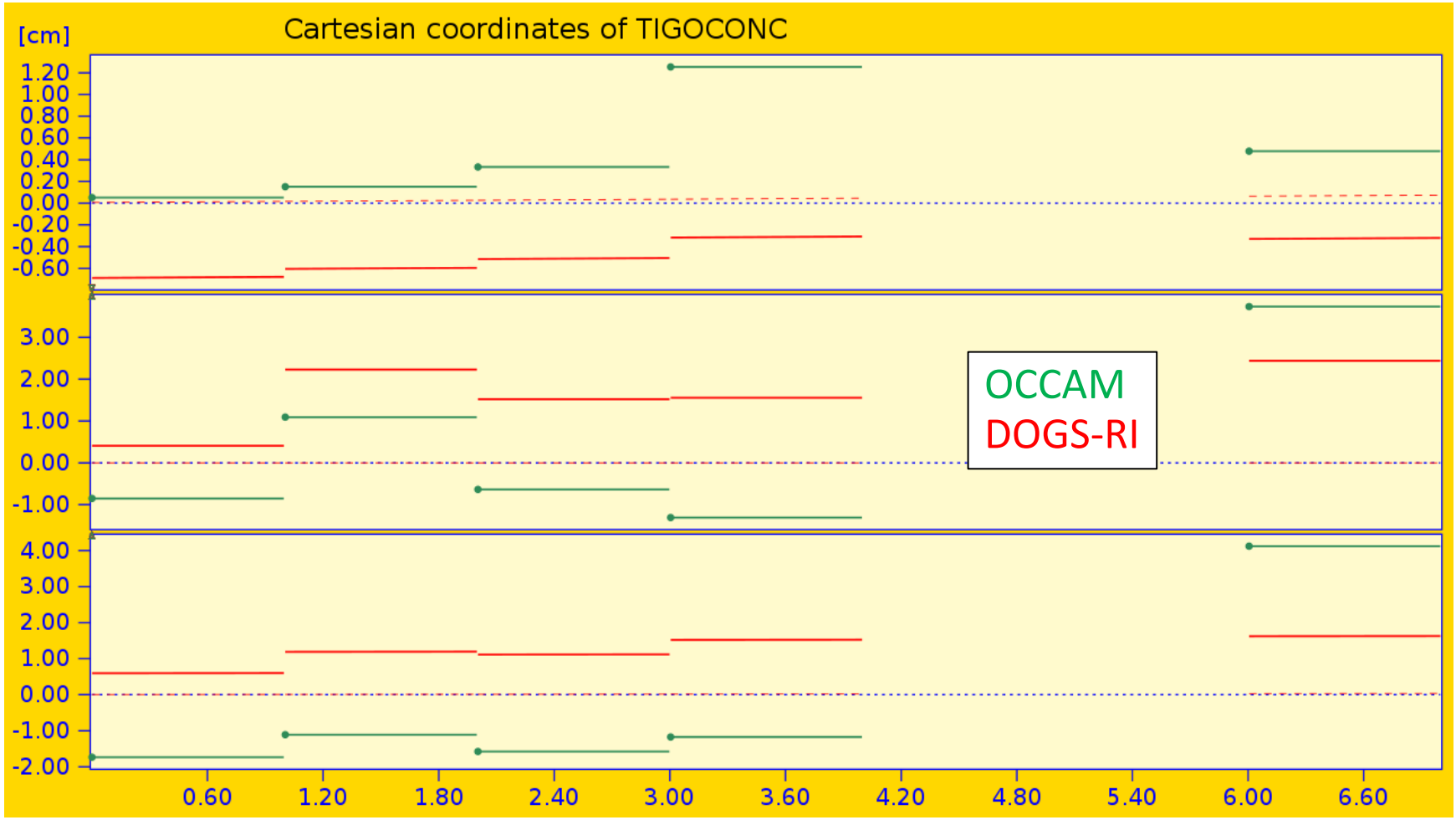


X

Y

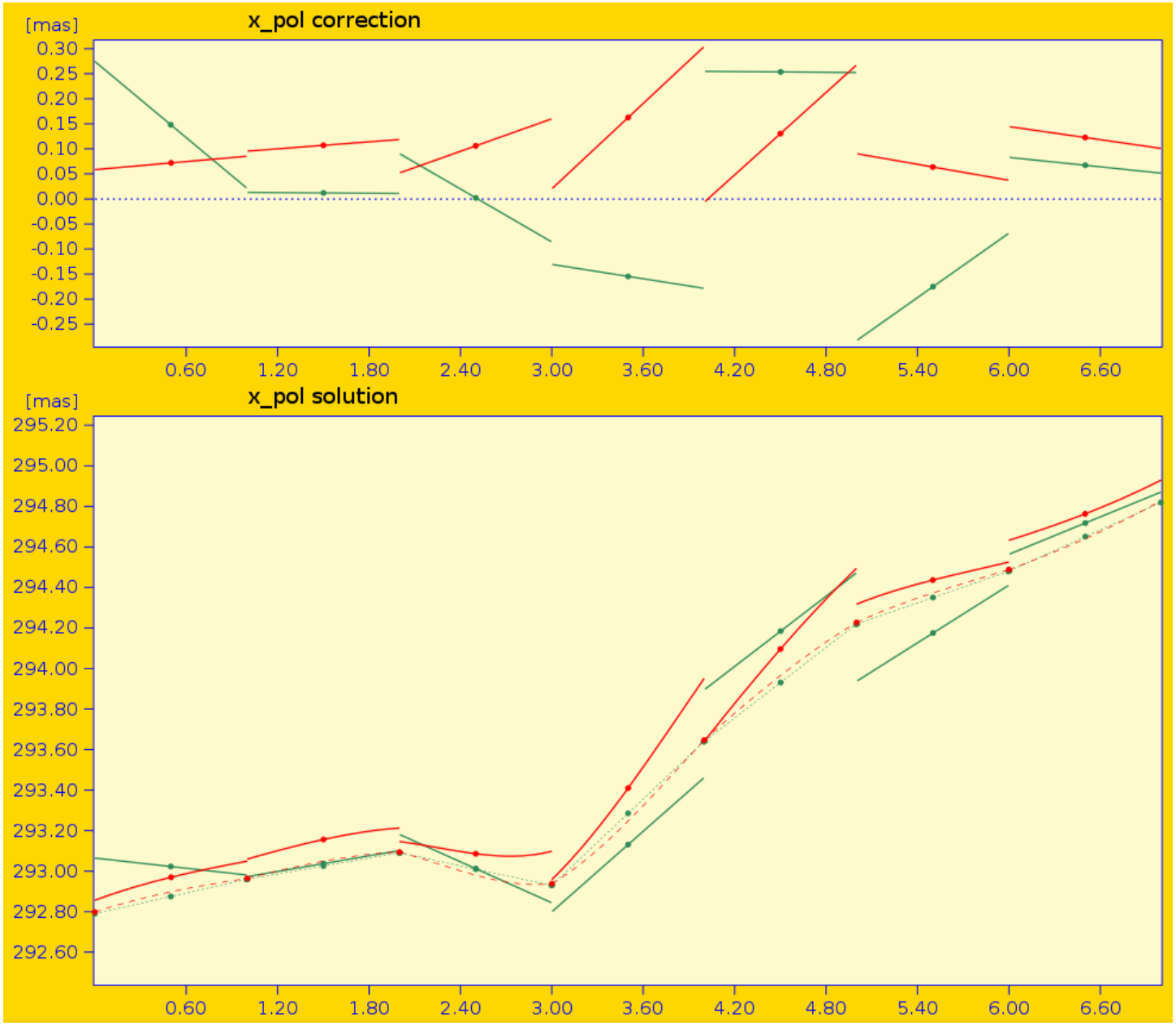
Z

CONT08 station coordinates (2)



CONT08 Earth orientation parameters

OCCAM
DOGS-RI



DOGS-RI: next steps

- participation in the "**VLBI Analysis Software Comparison Campaign 2015**" organized by the Chalmers University of Technology with OCCAM and DOGS-RI
- submission of DOGS-RI **test solutions** (one year of data?) to the IVS Combination Center for validation
- **parallel submission** of OCCAM and DOGS-RI solutions for the routine R1 and R4 sessions
- switch from OCCAM to DOGS-RI
- reprocessing with DOGS-RI using the OCCAM preprocessing options

OCCAM reprocessing

- in order to include **radio source coordinates**
- current status: consistent set of solutions from **December 2004** until August 2015 available (about 10.5 years)
- latest session solutions validated via the official **IVS rapid combination**; no quarterly solutions since mid of 2014

(Combined) Multi-year reference frame

	GNSS	SLR	VLBI
Institution	CODE	DGFI-TUM	DGFI-TUM
Software	Bernese	DOGS-OC	OCCAM
Resolution	daily	weekly	session-wise
Time span	July 2005 - August 2015		
Datum conditions (station coord.)	NNR/NNT/NNS	NNR	NNR/NNT
Coord. jumps	according to DTRF2014 processing		

Solution characteristics

GNSS:

- CODE's contribution to repro2/ITRF2014 ("cf2"), complemented by operational solutions ("cof") for the latest months

SLR:

- DGFI-TUM solution based on LAGEOS-1/2
- 7-day orbits
- stations with less than 10 normal points excluded

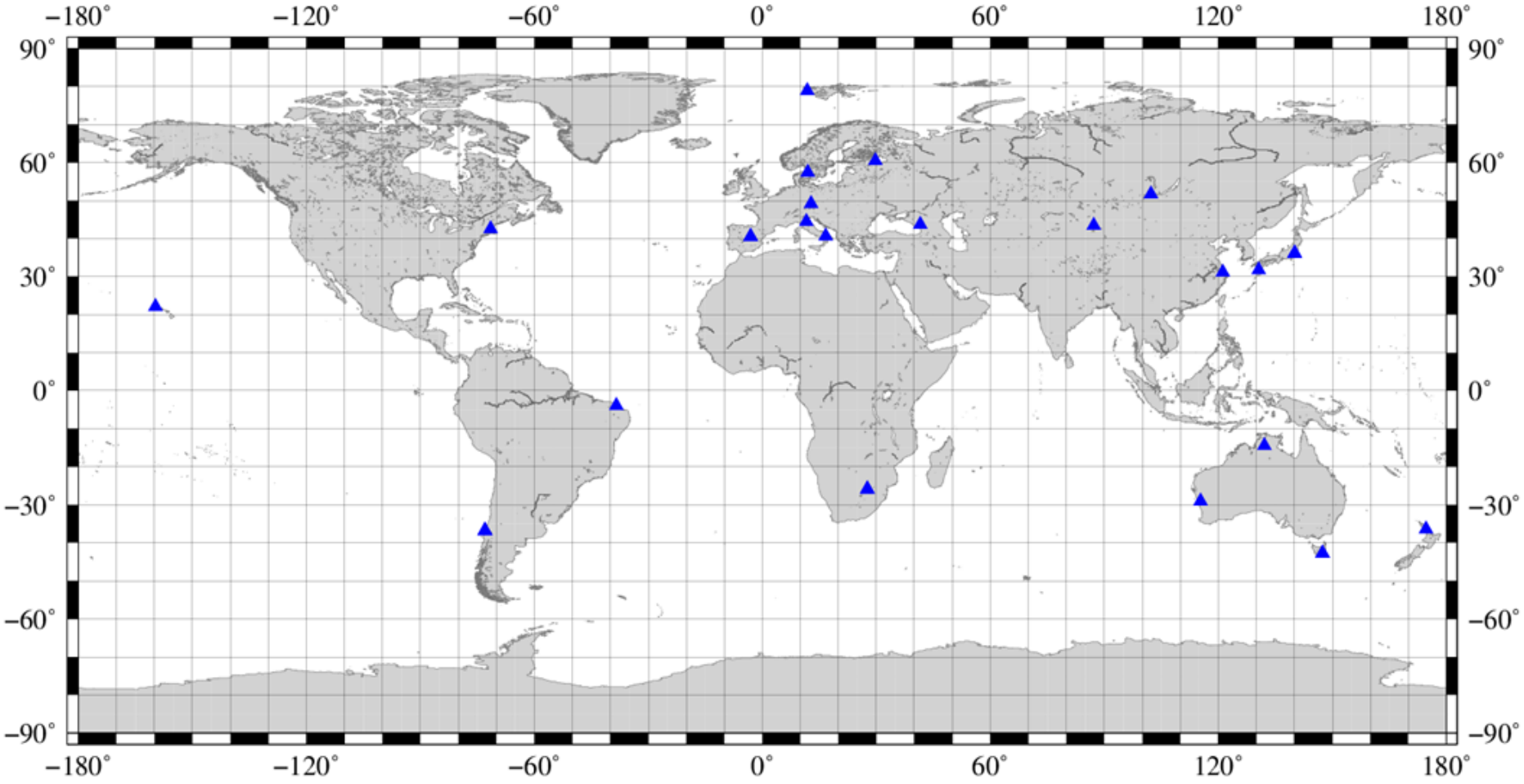
VLBI:

- DGFI-TUM solution considering more than 1400 24-hour sessions (**all types of sessions**)
- stations contained in less than 7 sessions excluded
- NNR condition w.r.t. **ICRF2 defining sources**

Transformation parameters w.r.t. DTRF2014

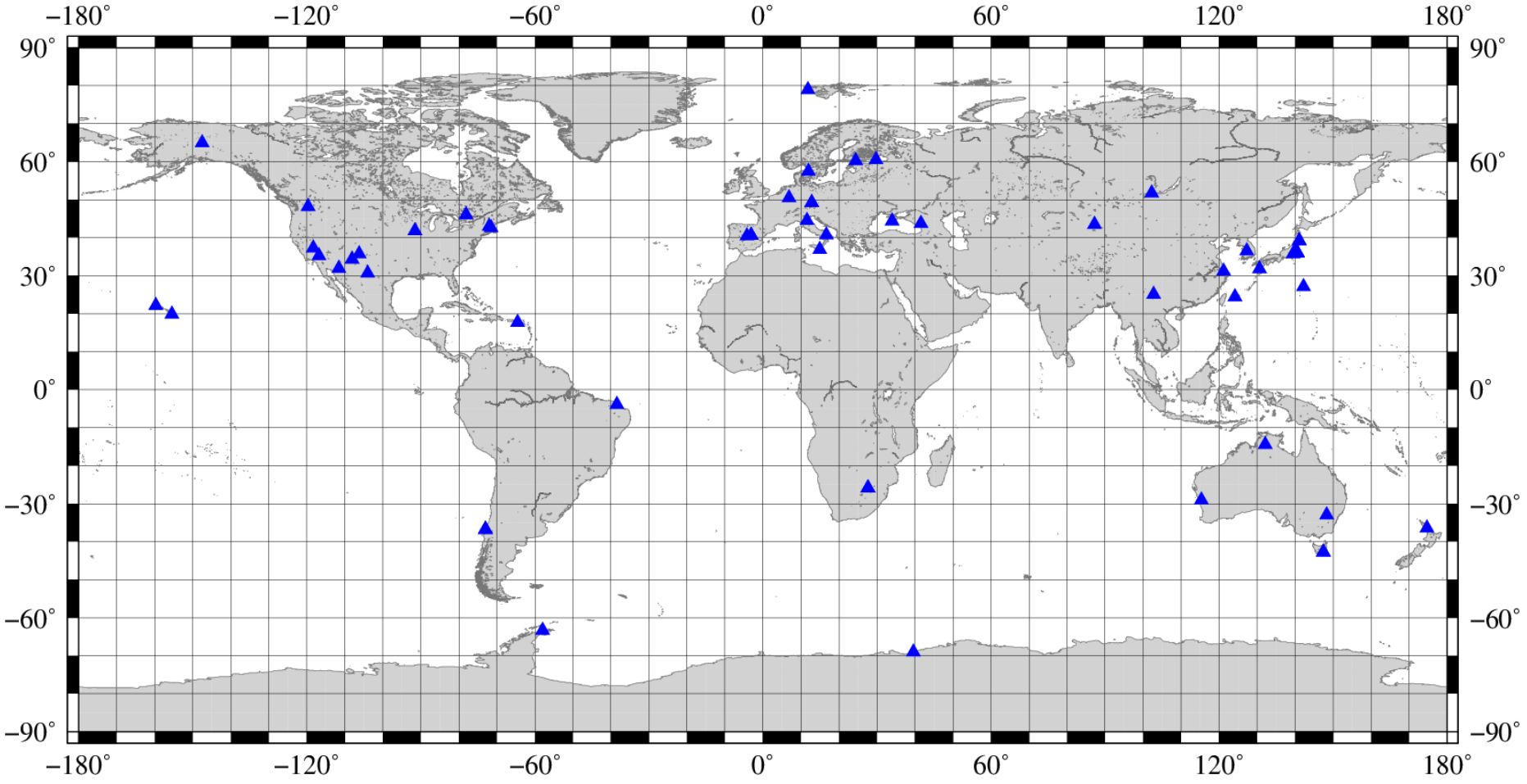
		Tx	Ty	Tz	Scale	STD	RMS
GNSS	Offset [mm]	**2.3**	**0.7**	**0.7**	**-0.7**	**1.8**	**1.8**
	Rate [mm/a]	0.4	0.1	0.2	-0.1		0.4
SLR	Offset [mm]	**4.5**	**-0.3**	**2.0**	**-2.1**	**4.3**	**4.2**
	Rate [mm/a]	0.9	-0.1	0.6	-0.4		1.0
VLBI	Offset [mm]	**1.2**	**0.8**	**0.5**	**-2.3**	**7.2**	**6.5**
	Rate [mm/a]	-0.3	0.1	0.0	0.2		3.0

VLBI stations



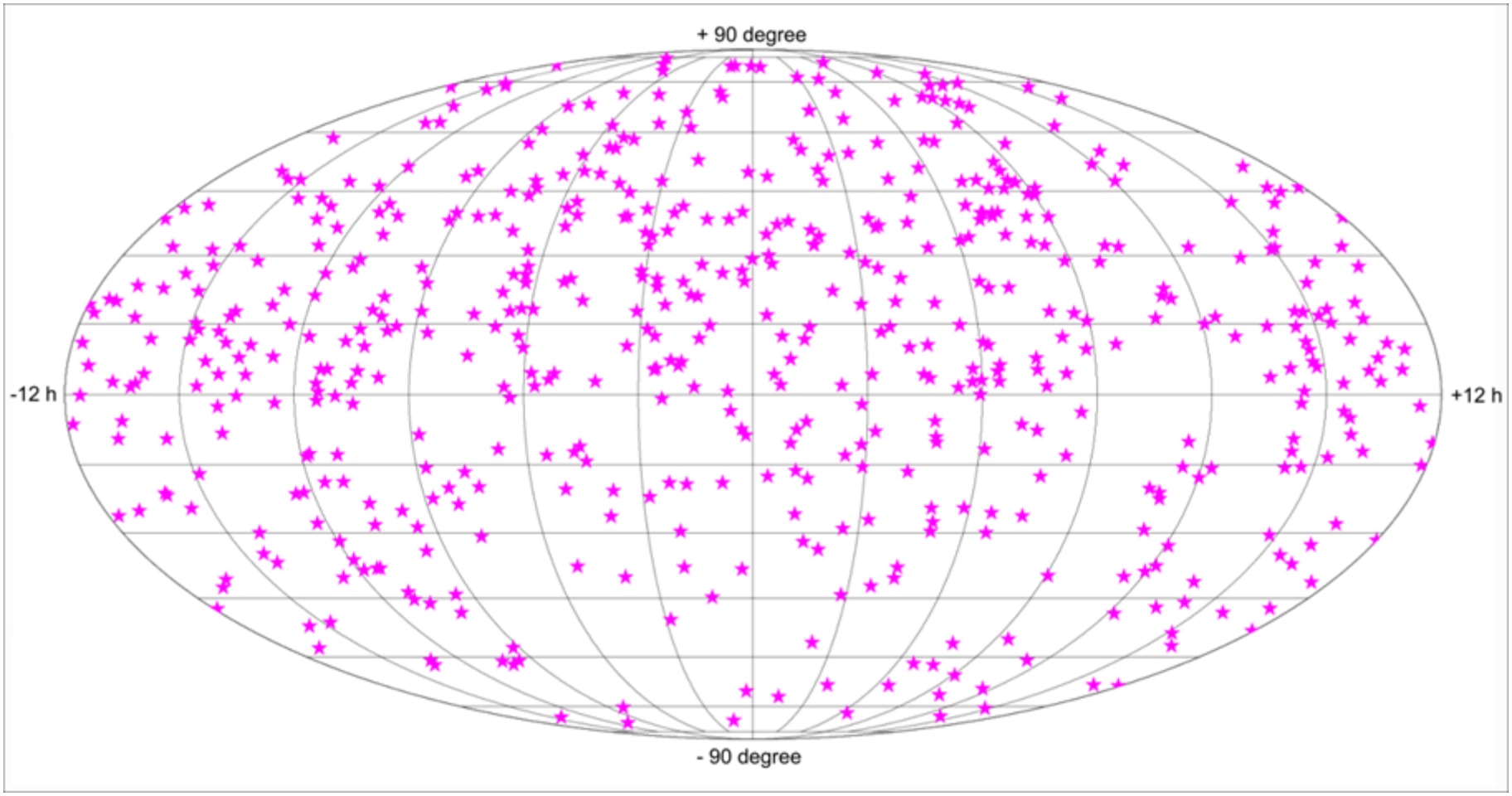
Hannover meeting (R1/R4 sessions only): 22 stations

VLBI stations



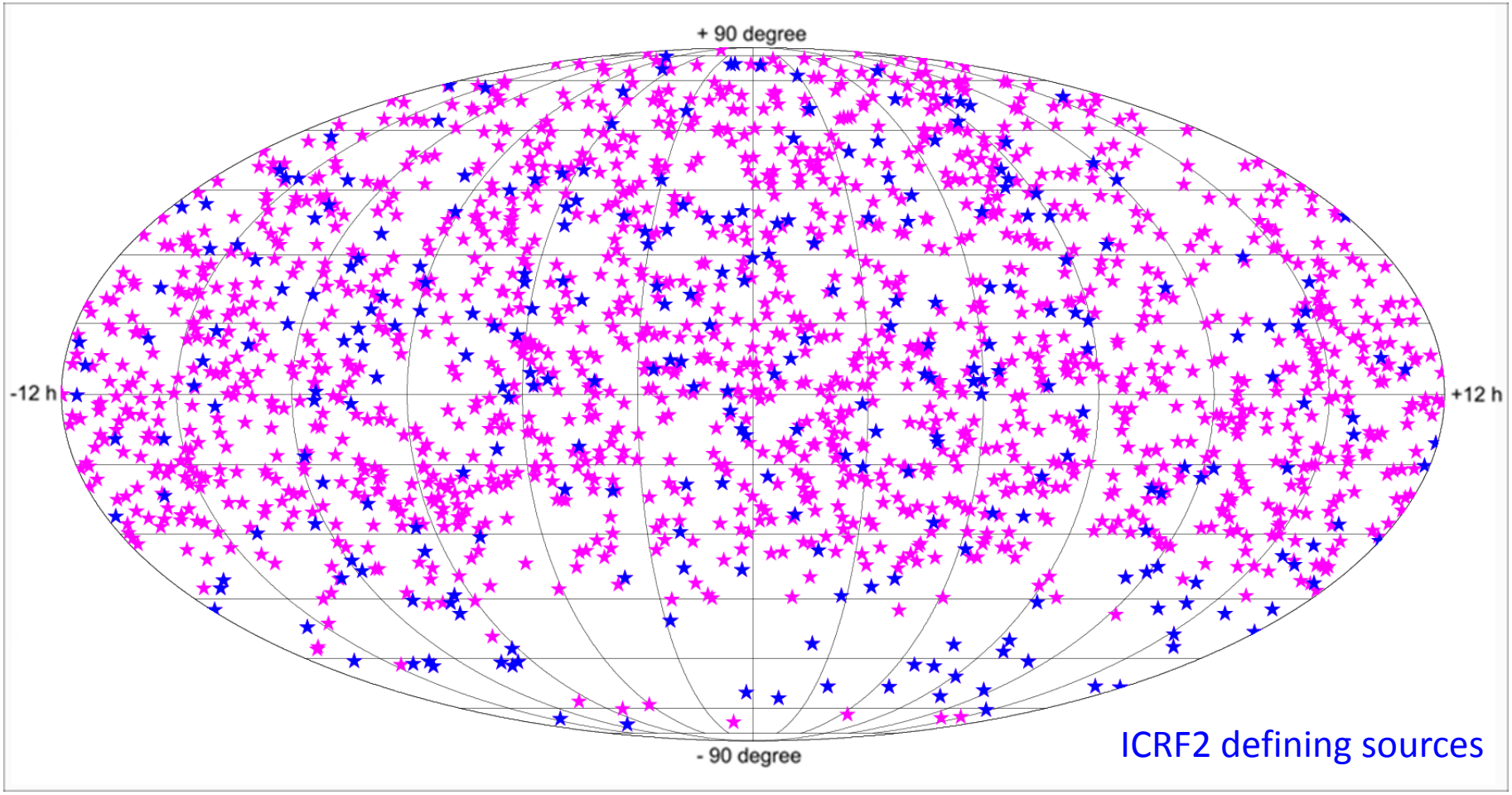
Hannover meeting (R1/R4 sessions only): 22 stations
Frankfurt meeting (all session types): **55 stations**

Radio sources



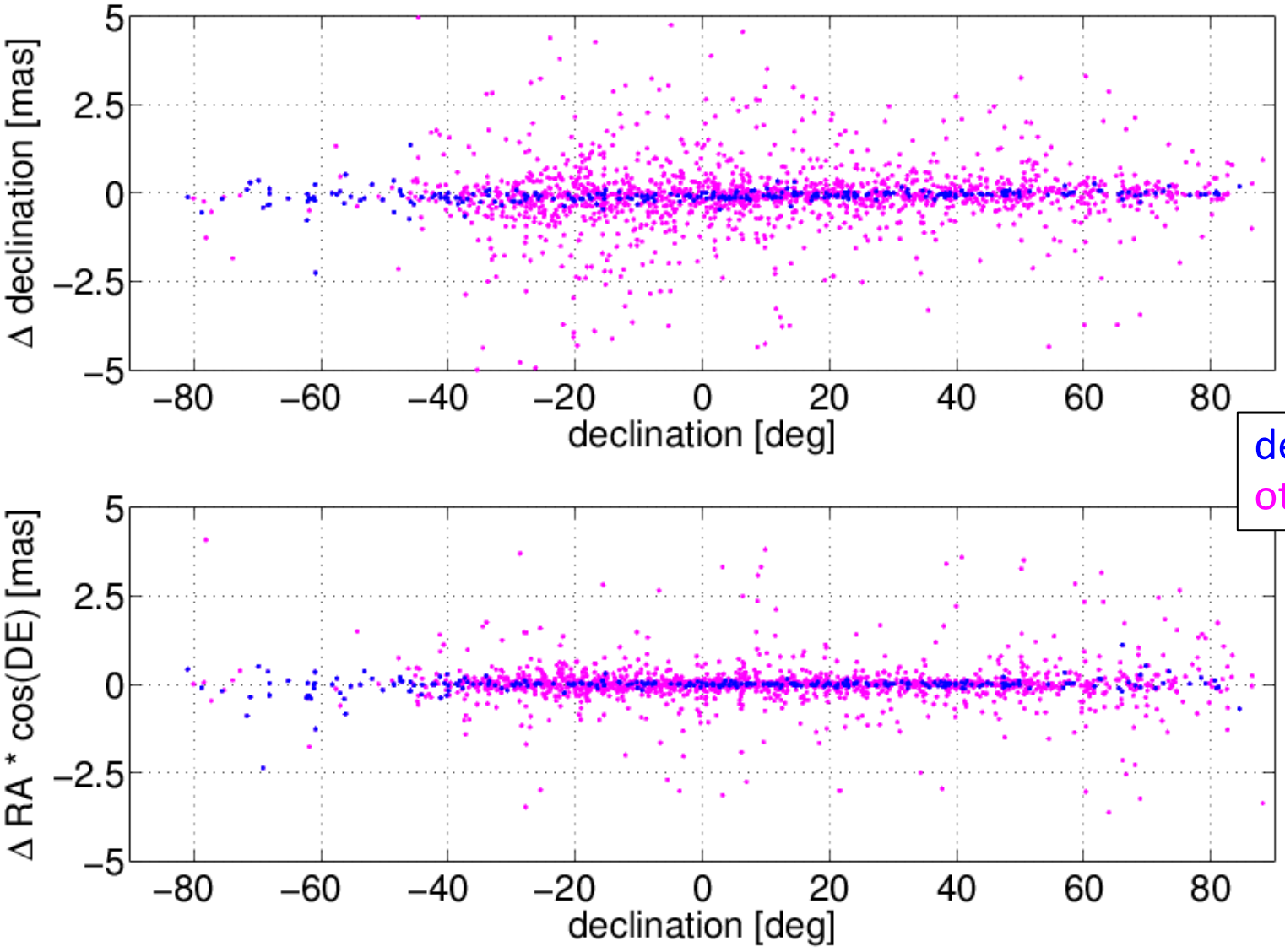
Hannover meeting (R1/R4 sessions only): 565 sources

Radio sources

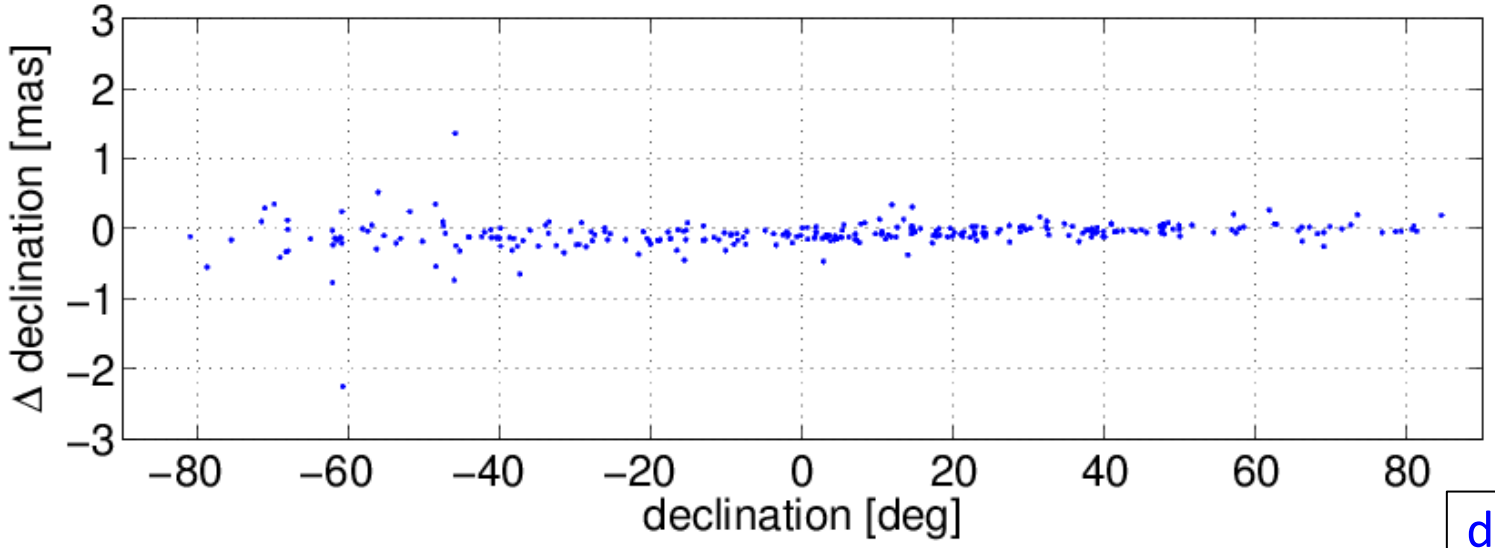


Hannover meeting (R1/R4 sessions only): 565 sources
Frankfurt meeting (all session types): **1851 sources**

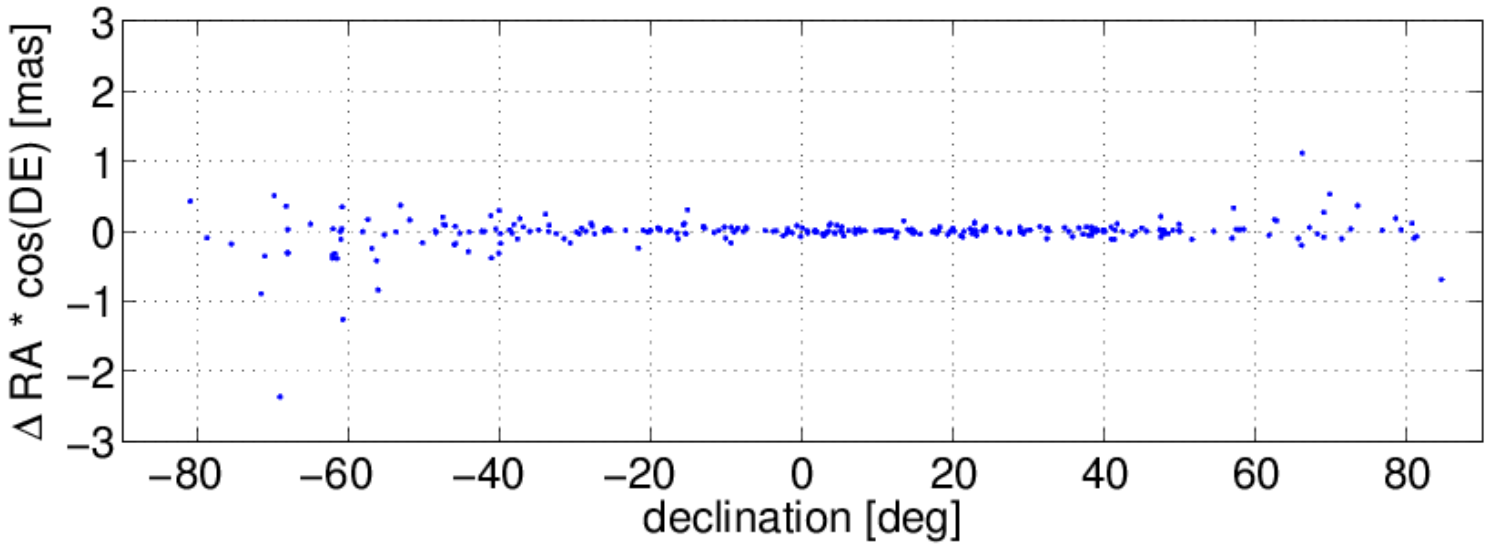
Source corrections (1)



Source corrections (2)



defining sources

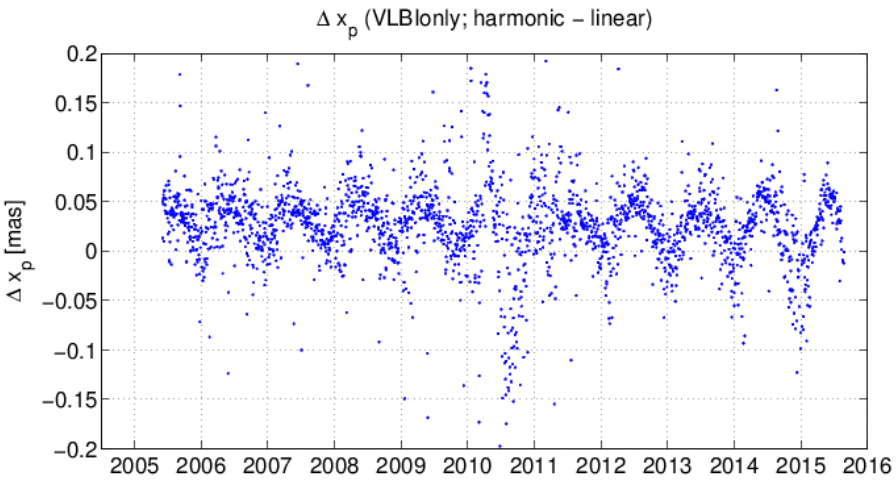


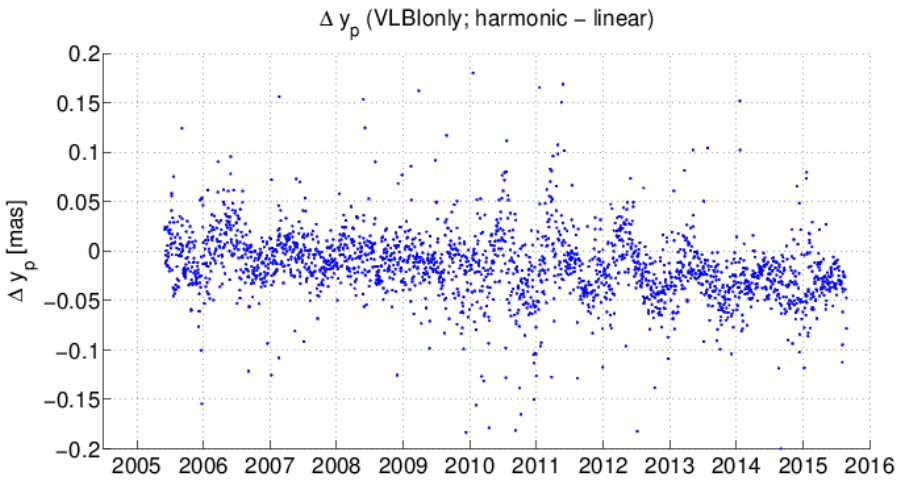
Solutions considering seasonal station variations

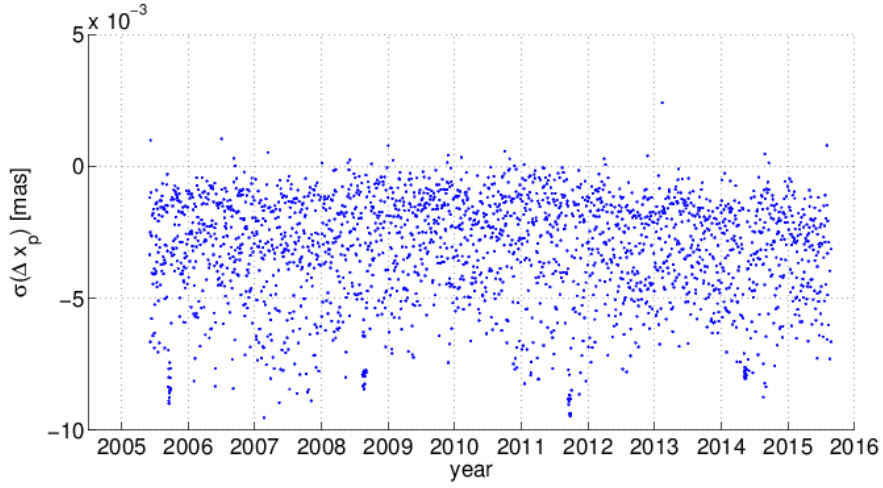
		Tx	Ty	Tz	Scale	STD	RMS
SLR	Offset [mm]	**4.5**	**-0.3**	**2.0**	**-2.1**	**4.3**	**4.2**
	Rate [mm/a]	0.9	-0.1	0.6	-0.4		1.0
SLR seas. signal	Offset [mm]	**4.6**	**0.0**	**1.9**	**-0.6**	**4.5**	**4.4**
	Rate [mm/a]	0.5	0.0	0.9	-0.4		0.9
VLBI	Offset [mm]	**1.2**	**0.8**	**0.5**	**-2.3**	**7.2**	**6.5**
	Rate [mm/a]	-0.3	0.1	0.0	0.2		3.0
VLBI seas. signal	Offset [mm]	**0.1**	**1.9**	**-3.2**	**0.5**	**7.7**	**7.1**
	Rate [mm/a]	-0.3	0.1	0.0	0.1		3.0

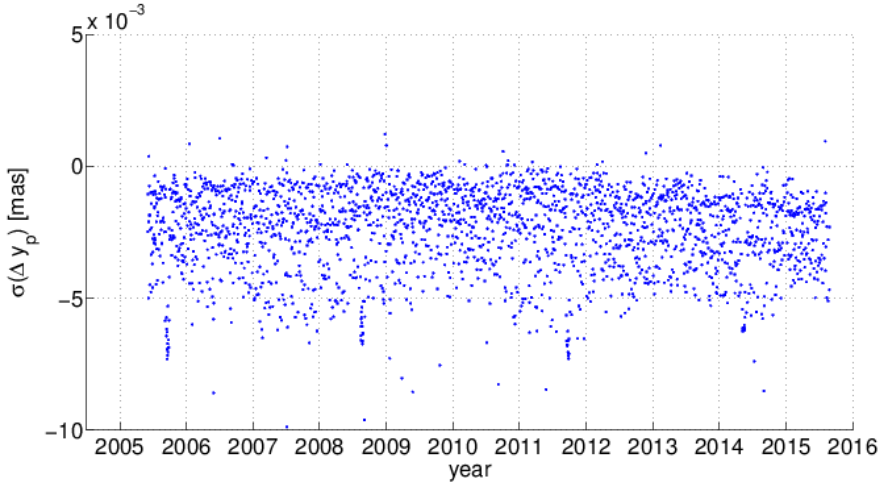
Amplitudes for a small subset of well-distributed stations fixed to zero (SLR: 5 stations, VLBI: 7 stations)

Impact of seasonal station variations on pole



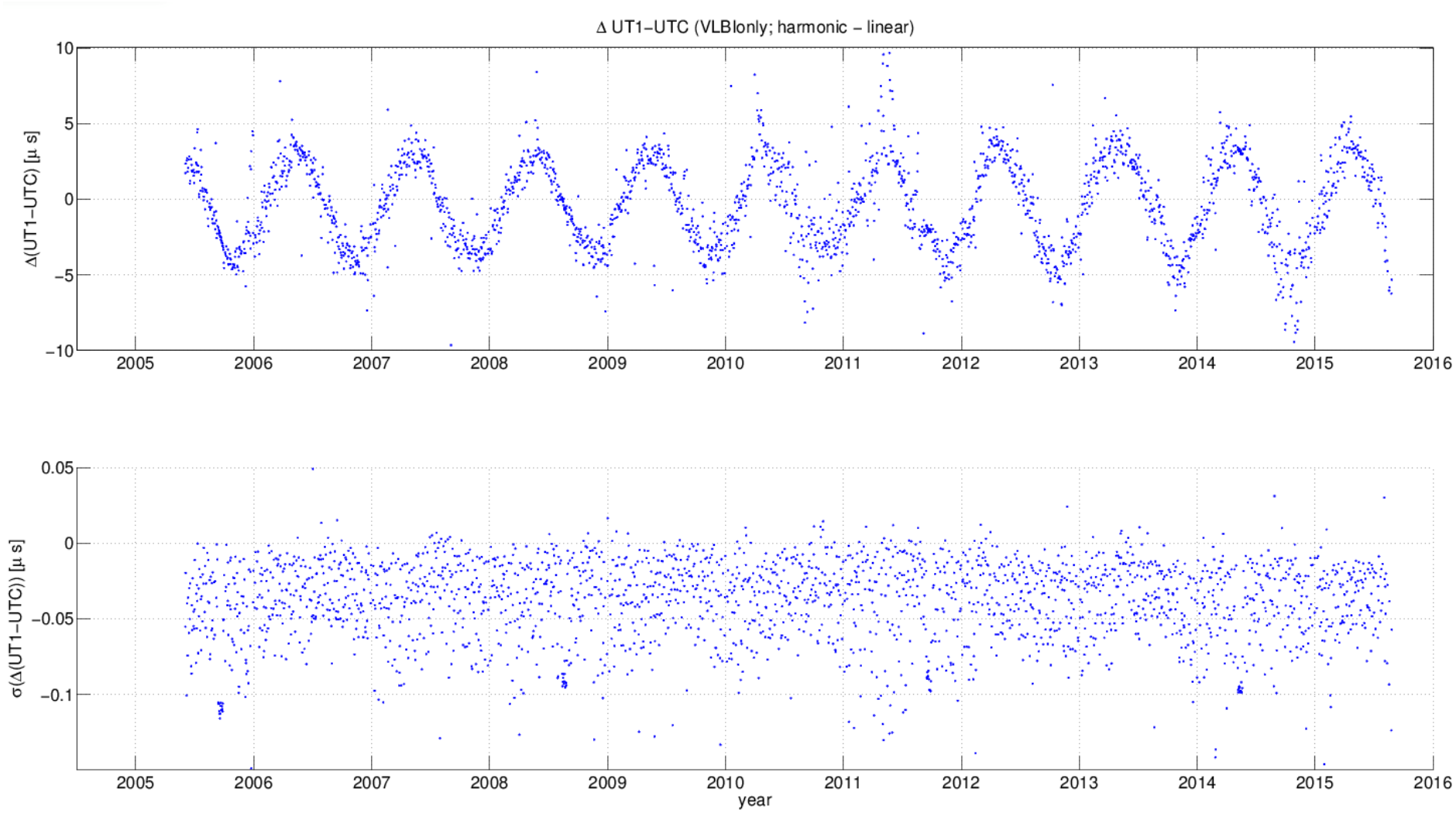






DFG Forschergruppe Referenzsysteme

Impact of seasonal station variations on UT1-UTC



Summary

- DOGS-RI ready for final validation steps
- consistent VLBI time series available from December 2004 to August 2015
- accumulation of all IVS session types to multi-year reference frame successful
- systematic EOP differences between solutions with and without seasonal station variations
- 10-year GNSS, SLR and VLBI solutions ready for combination and further studies