

Local Tie Results from the CONT'02 Campaign

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IERS Workshop 2003 on „Site Co-location“

**October 23-24, 2003
Matera, Italy**

Content:

- **CONT'02 Campaign**
- **Local Ties**
- **Systematic Biases (troposphere and coordinates)**

CONT'02:

- 2 weeks of continuous VLBI observations:
October 17 - 30, 2002
- 8 VLBI stations
- Analysed at DGFI

For comparison and combination with GPS:

- 150 GPS stations; analysed at TUM
- Local tie information for the 8 co-location stations:
 - Ny-Alesund: Terrestrial measurements of GIUB, 2002
 - Others: Files from ITRF2000



**Use of identical models and parameterization for
GPS and VLBI analysis**

Selection of local ties

		Technique solutions		Combination (7 LT xyz)		ITRF2000
		TUM	DGFI	TUM	DGFI	
ALGO	Lat.	2,0	-2,3	-0,7	-0,4	-3,0
	Long.	2,6	-2,7	-1,9	-0,8	-3,0
	Height	18,4	30,4	0,1	3,8	15,4
FAIR	Lat.	-9,4	-15,3	-5,3	-4,8	-16,8
	Long.	-0,8	2,6	-0,5	-1,7	5,4
	Height	38,8	56,5	1,4	4,8	20,0
HRAO	Lat.	1,4	-1,4	-1,0	-1,9	-9,2
	Long.	21,4	21,2	0,2	1,4	14,4
	Height	45,2	46,5	0,4	2,6	11,8
KAUA	Lat.	33,8	36,1	21,9	37,4	-4,0
	Long.	21,0	26,2	31,3	18,0	-3,4
	Height	23,6	18,1	15,3	8,8	14,6
NYAL	Lat.	-7,0	1,7	-2,3	4,0	0,8
	Long.	6,4	0,8	3,6	-1,0	-0,8
	Height	-32,8	33,8	5,1	2,0	-11,8
ONSA	Lat.	0,6	3,8	-1,1	-0,4	3,6
	Long.	6,4	2,5	-0,5	-0,2	-1,8
	Height	-14,2	-7,6	-0,2	-0,3	-0,4
WEST	Lat.	2,6	0,7	-0,2	1,9	-2,6
	Long.	14,8	9,8	2,0	6,9	4,6
	Height	35,2	37,6	0,5	2,4	18,4
WTZR	Lat.	-3,4	1,4	-1,8	-1,7	-0,2
	Long.	6,2	3,1	-0,8	-1,3	-0,4
	Height	3,0	-4,5	-0,3	0,1	1,2

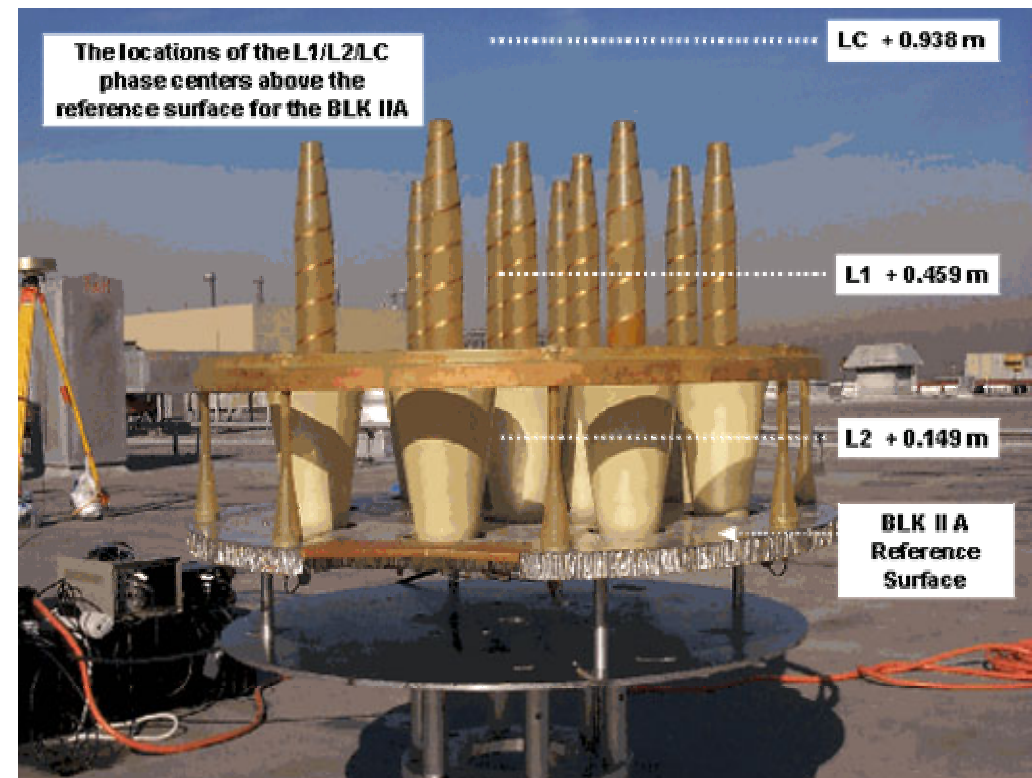


Antenna Phase Center Corrections

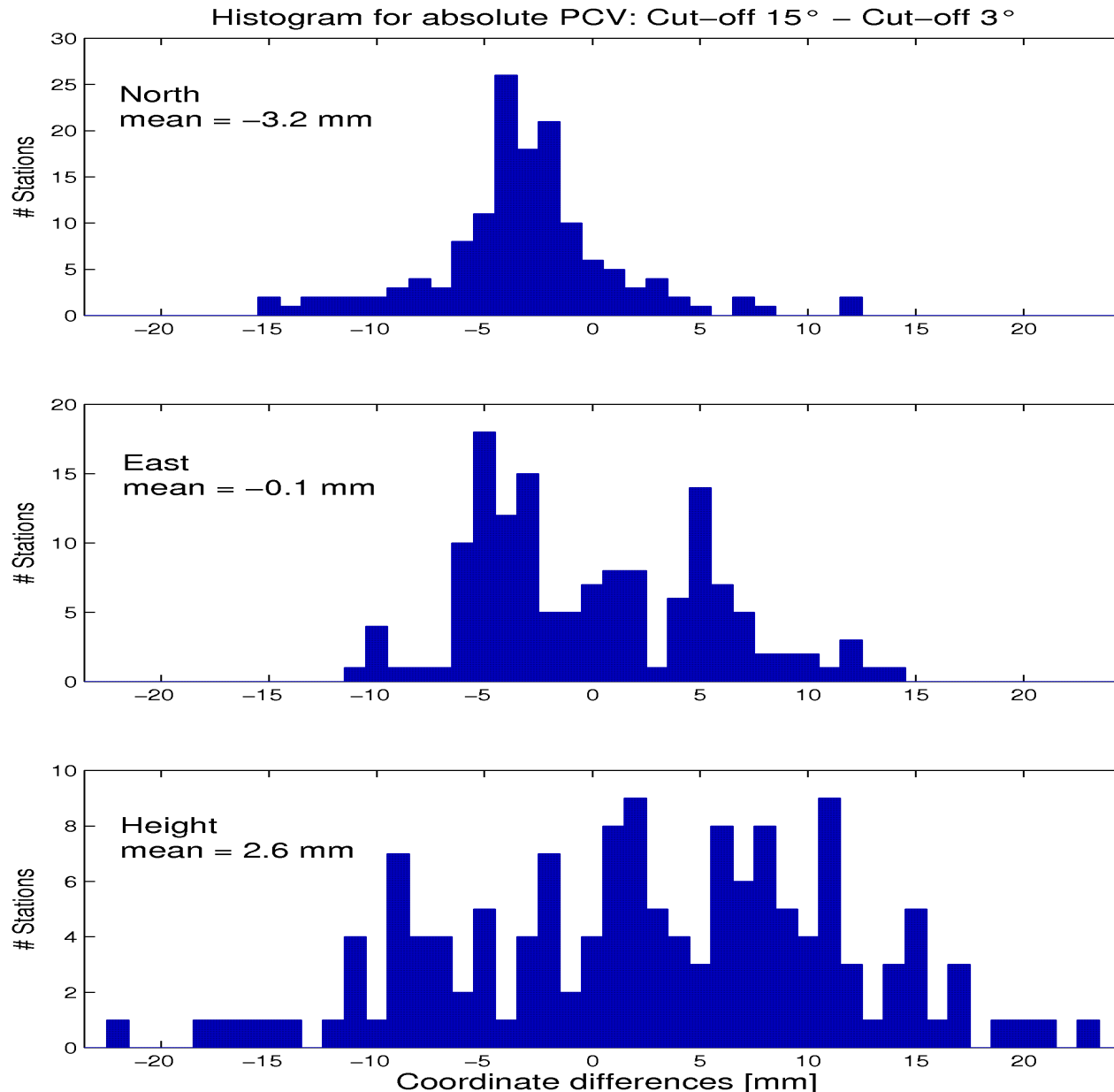


Antenna phase center variations:

- GPS receiver antenna
- GPS satellite antenna

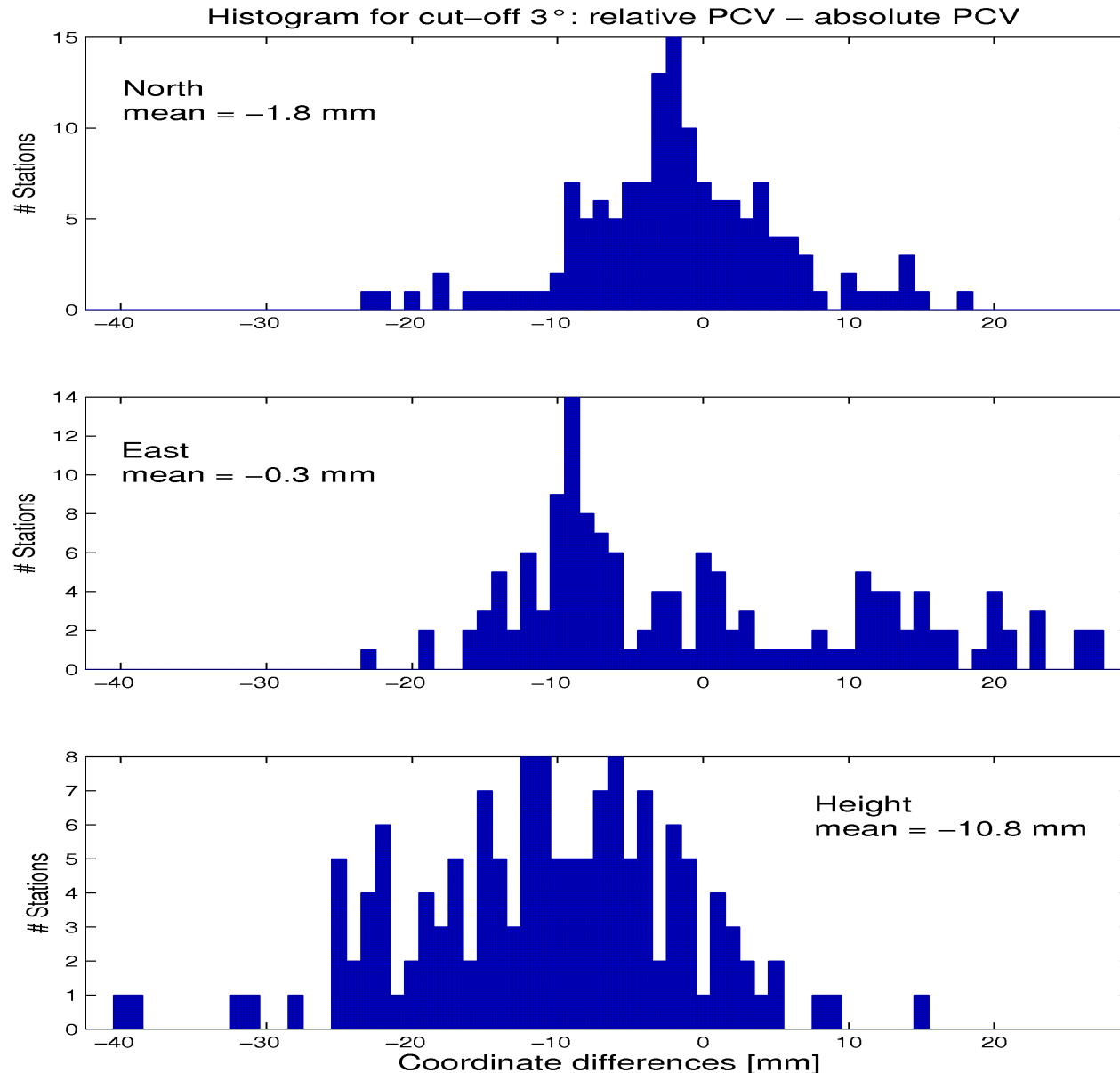


GPS: Elevation Cut-Off Effect



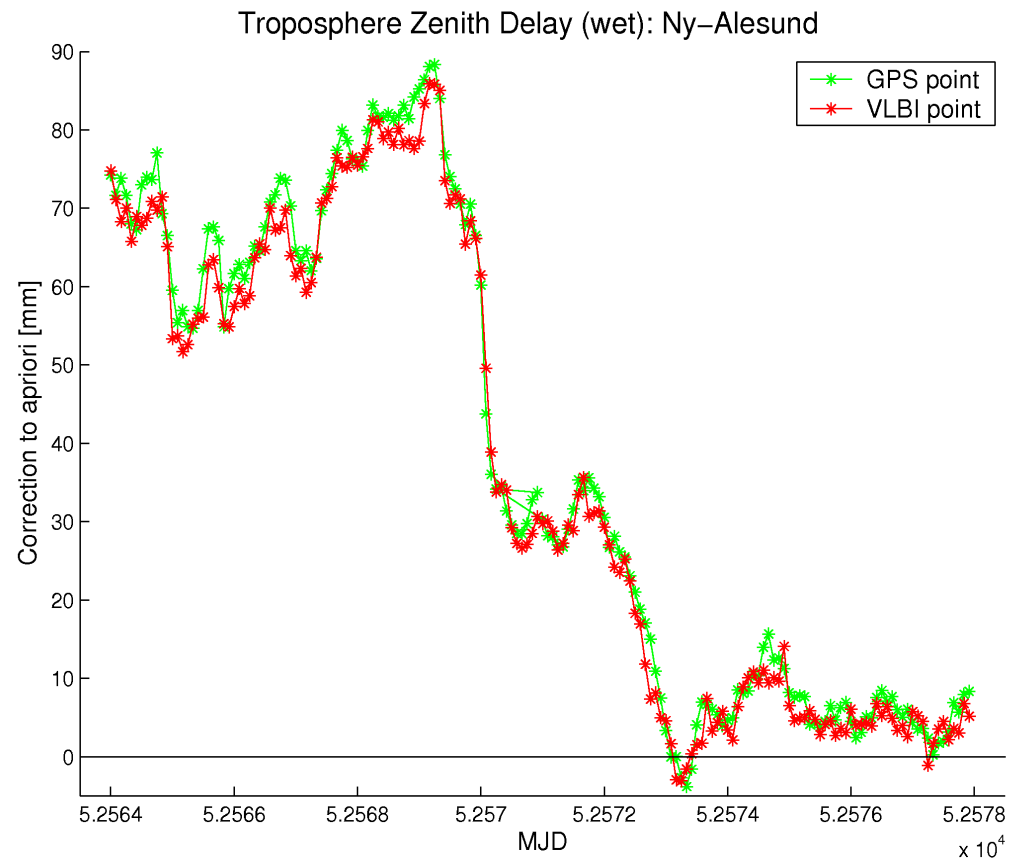
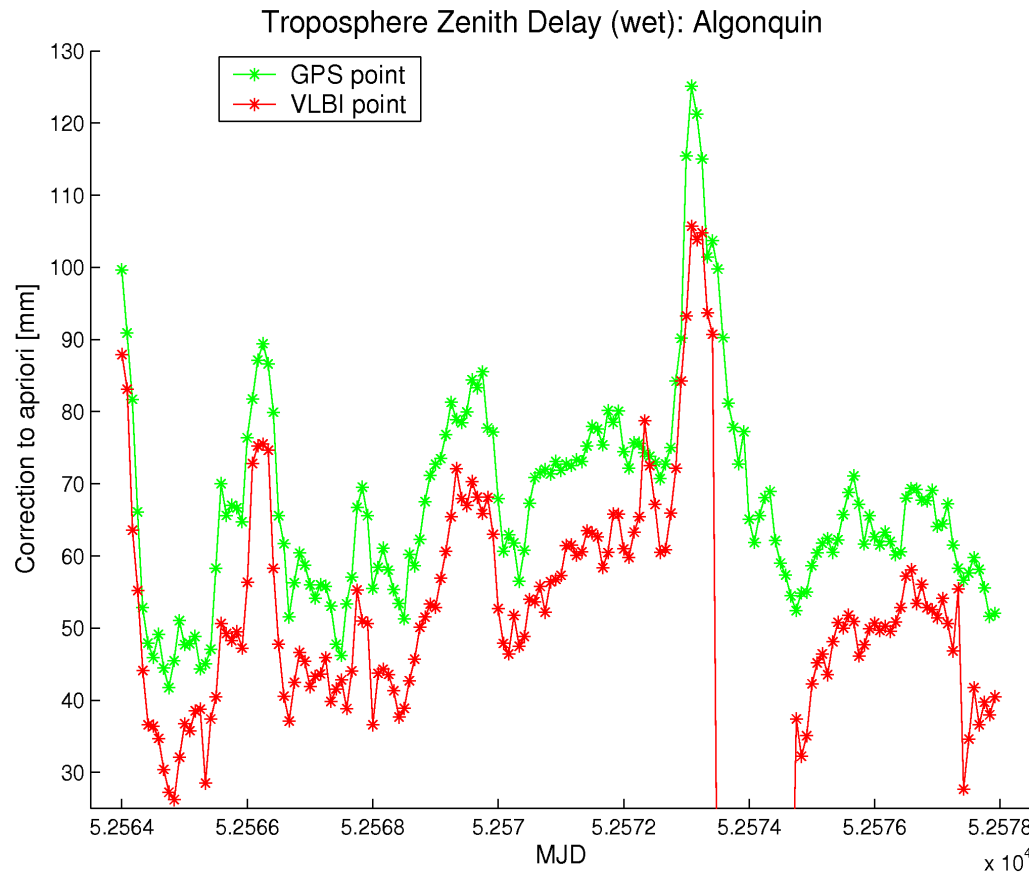
- Change of station coordinates due to a change in **elevation cut-off angle**
- Most up-to-date **absolute phase center variations** used for receivers (robot measurements) and satellites (global estimation)
- **Antennas are a critical error source !**

GPS: Absolute-Relative Antenna Patterns



- Change from **relative** (now in use) to **absolute** antenna information (to be used by IGS in future)
- Absolute phase center variations only derivable with fixed ITRF scale.
- Systematic change in scale to ITRF (several mm)

Comparison of GPS & VLBI Troposphere

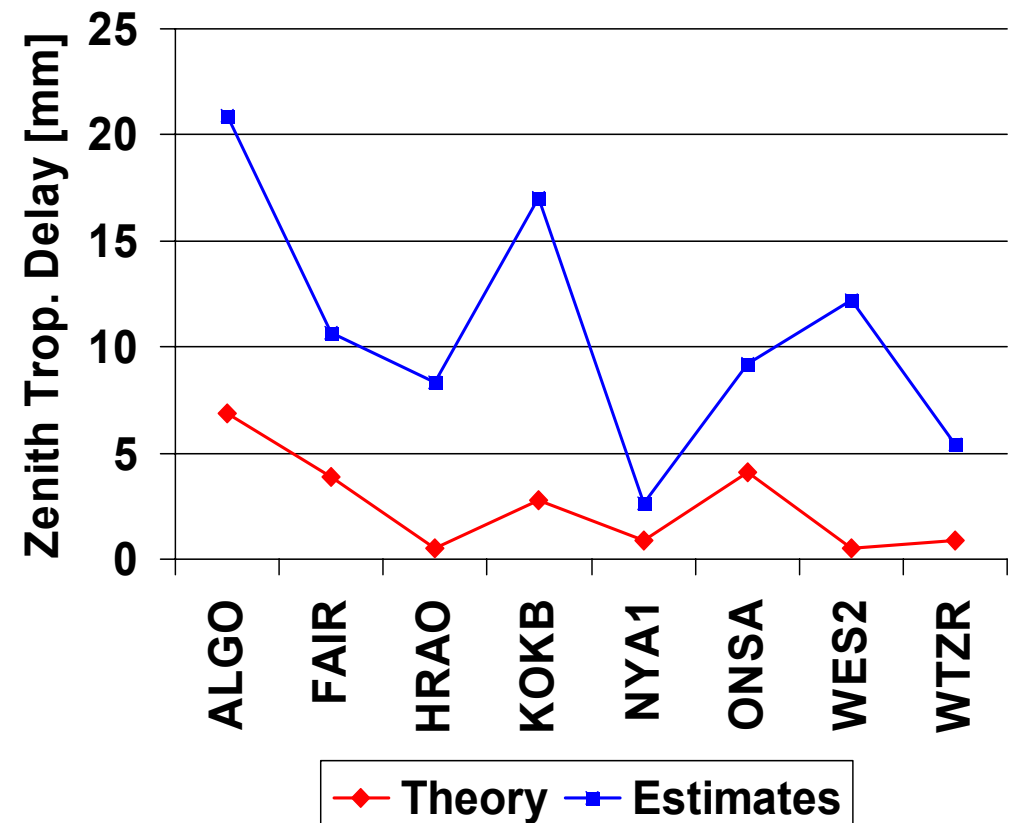


- CONT'02 Campaign (14 days)
- Very nice agreement in temporal variations, but **large systematic biases** between VLBI and GPS, indicating some unmodeled effects

Comparison of GPS & VLBI Troposphere

Station	Δ Height (local tie) [m]	Δ ZTD Theory [mm]	Δ ZTD Estim. [mm]
ALGO	23.11	6.9	14.0
FAIR	13.08	3.9	6.8
HRAO	1.54	0.5	7.8
KOKB	9.24	2.8	14.2
NYA1	3.07	0.9	1.7
ONSA	13.71	4.1	5.1
WES2	1.75	0.5	11.7
WTZR	3.10	0.9	4.5

Difference between GPS and VLBI



Δ Height = 10m $\rightarrow$ Δ ZD $\approx$ 3mm

Conclusions

ITRF position/velocity solutions not ideal to check/validate local ties:

- Many changes of GPS receiver/antenna equipment
- Time series not available to check for jumps and consistency

Even with coordinate time series available there are problems:

- GPS results dependent on **elevation cut-off**
- Large systematic effects due to **antenna phase center** corrections (receiver and satellites)
- VLBI **telescope deformation** (elevation dependence ?)
- Especially problematic for **station heights** and **global scale**

Combination of troposphere zenith delays instead of station heights and constraints on horizontal local ties