

Current estimates of scale differences between techniques

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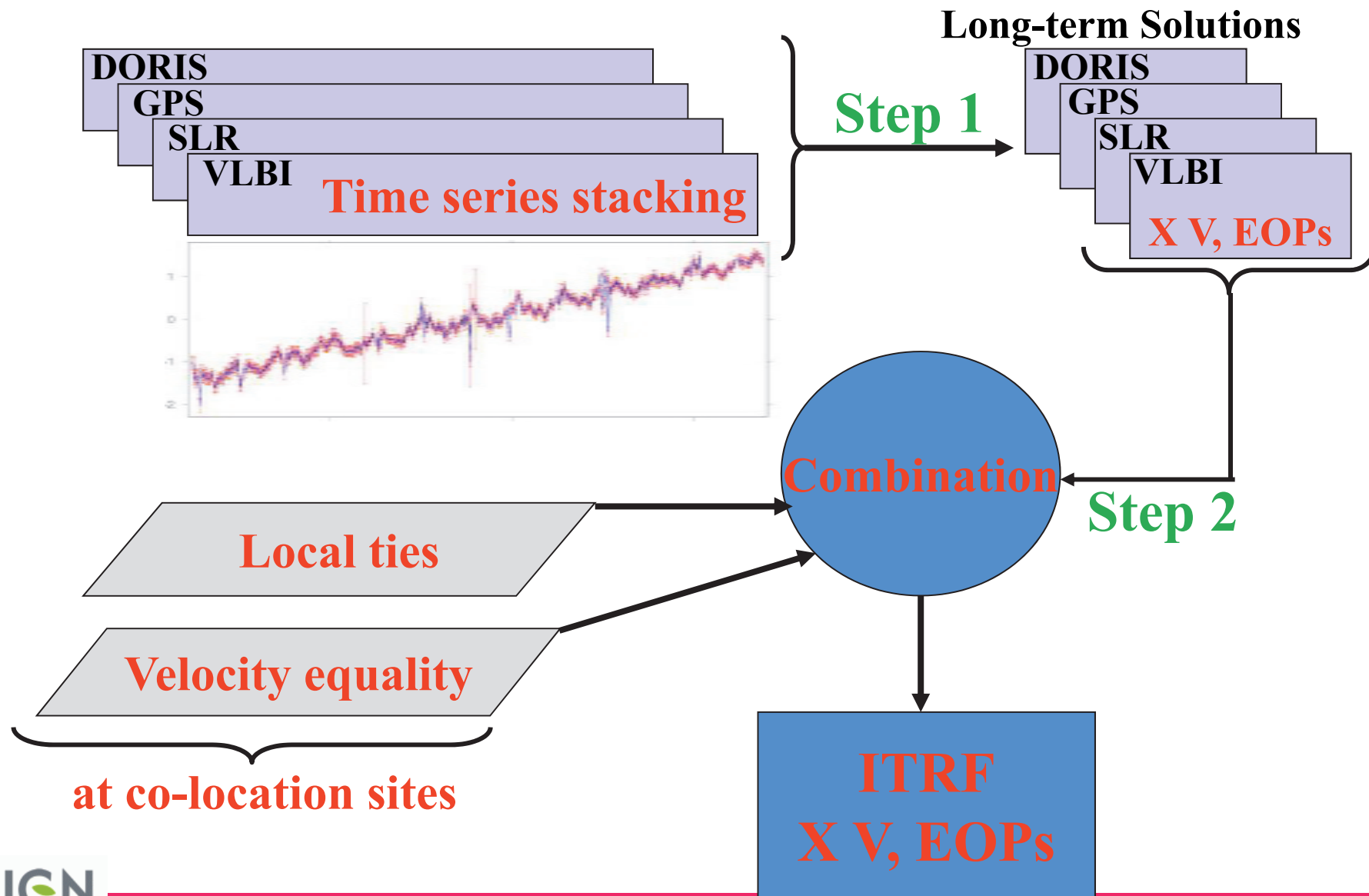
IGN, France



Data used

- Space Geodesy:
 - SLR: ILRS contribution to ITRF2008, extended up to 2013.96 by ILRS operational weekly SNX solutions
 - VLBI: GSFC 2011b session-wise solutions: 1983-2013.9
 - DORIS: IDS03v0 preliminary solution
 - GPS: 5 AC Repro2 solutions
- Local ties: ITRF2008 local ties + few new ties

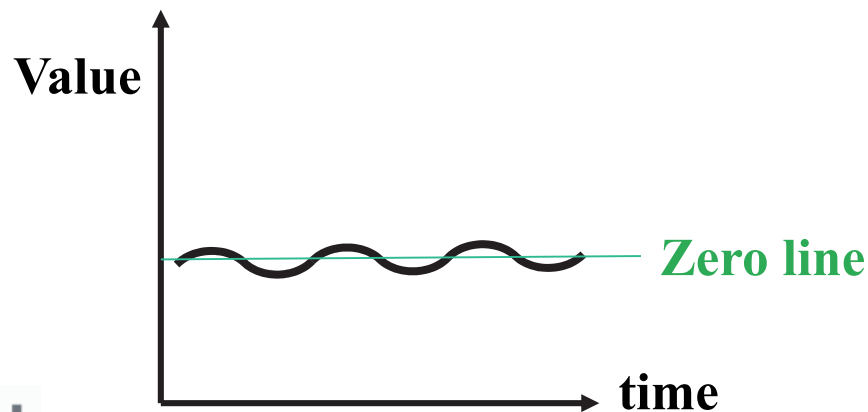
ITRF Construction



ITRF Combination: Step 1

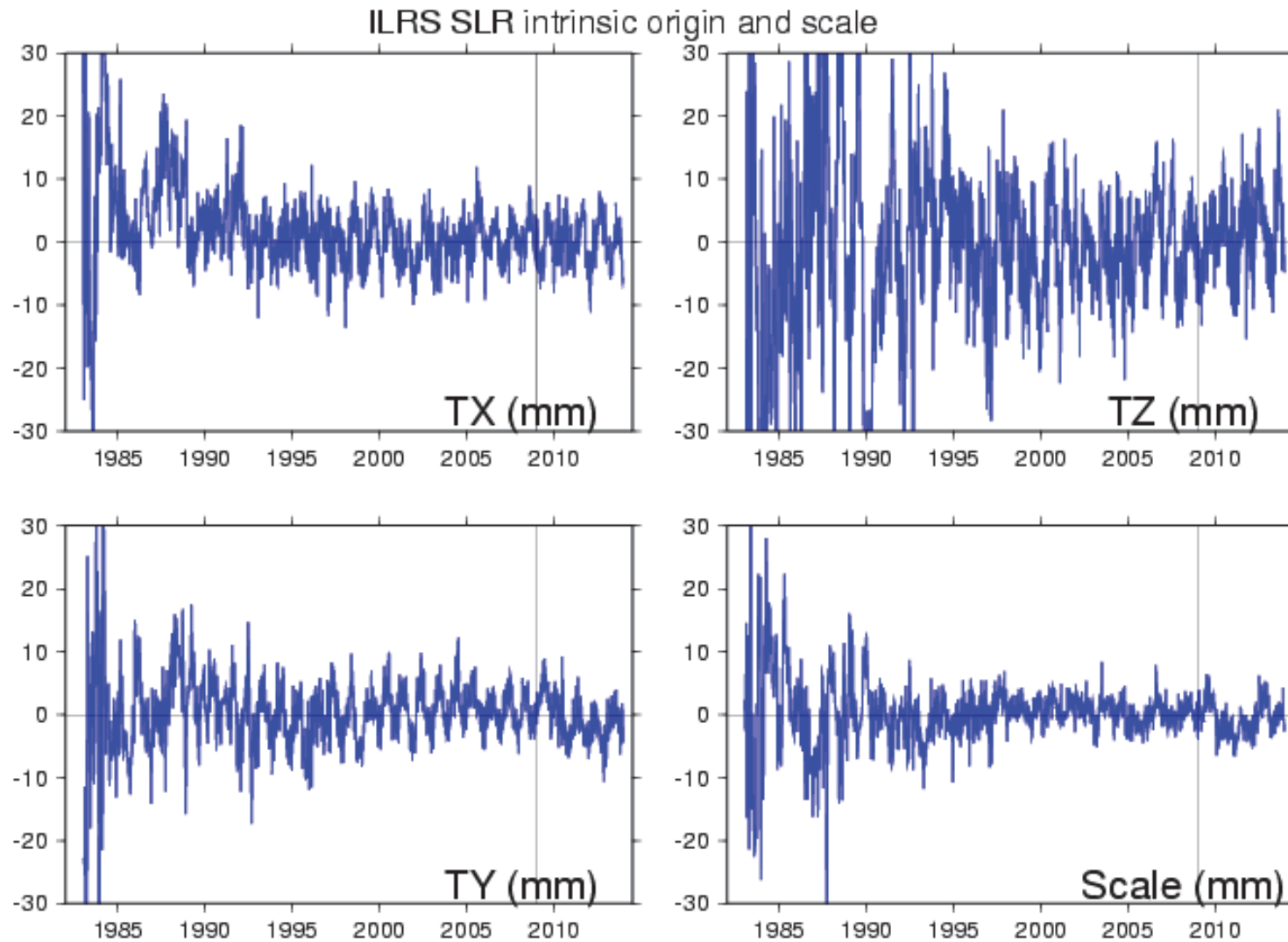
- **Stacking/accumulation of individual time series where the long-term**
 - origin of SLR and DORIS
- and**
 - scale of VLBI, SLR and DORIS

are defined via internal/intrinsic constraints (Altamimi et al., 2007):

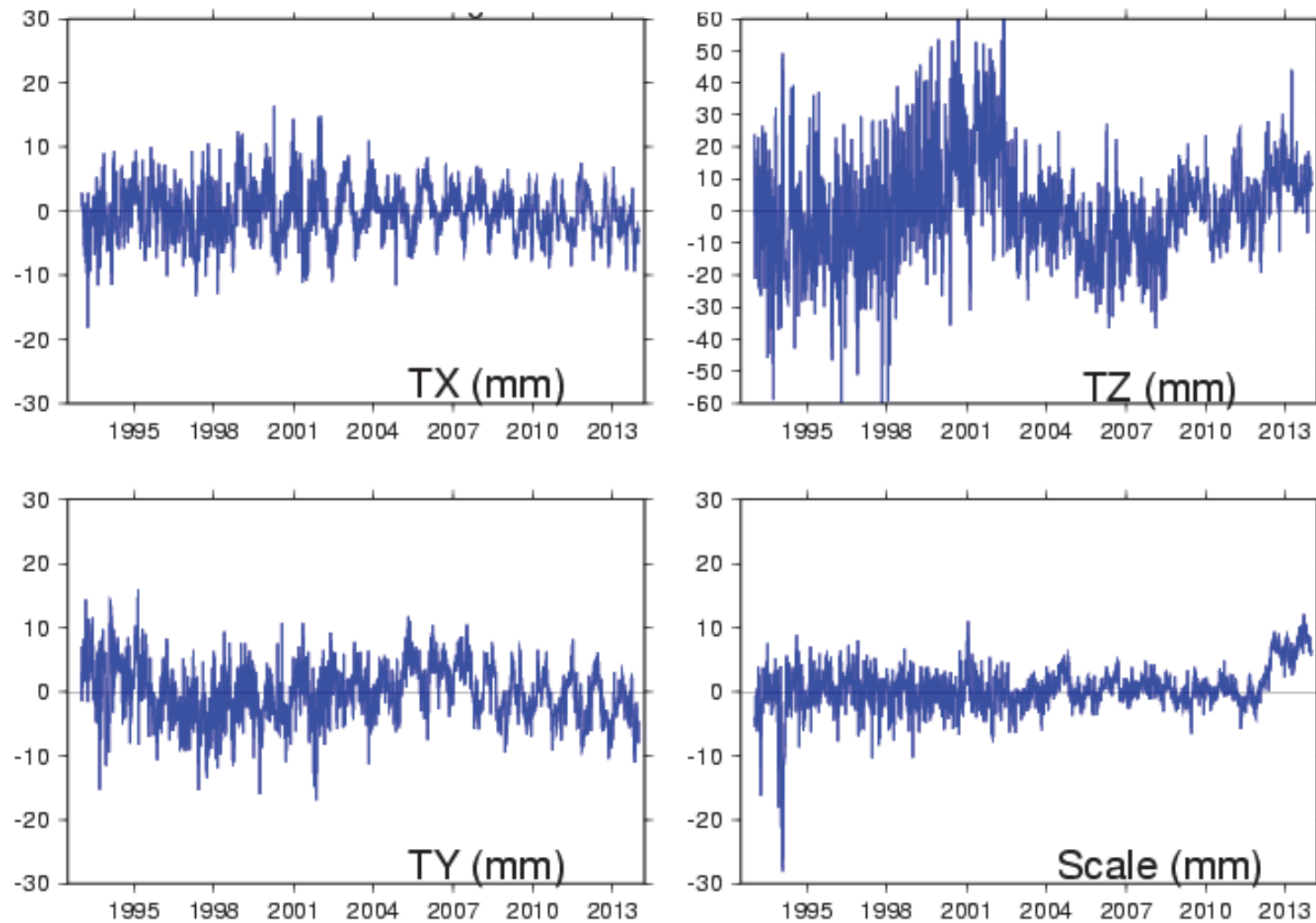


$$\begin{cases} \sum_{k \in K} P_k = 0 \\ \sum_{k \in K} (t_k - t_0) P_k = 0 \end{cases}$$

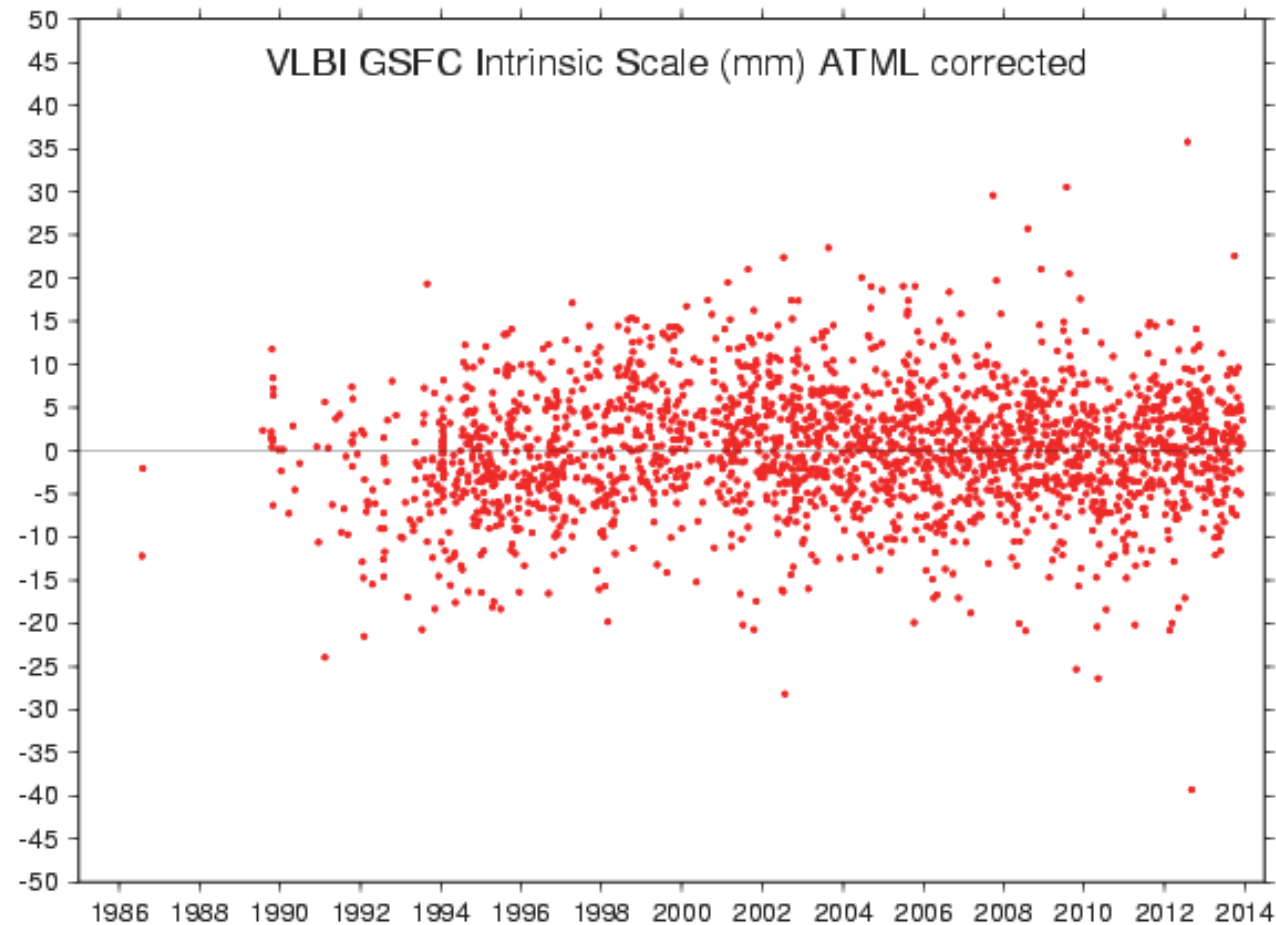
ILRS Intrinsic Origin&Scale



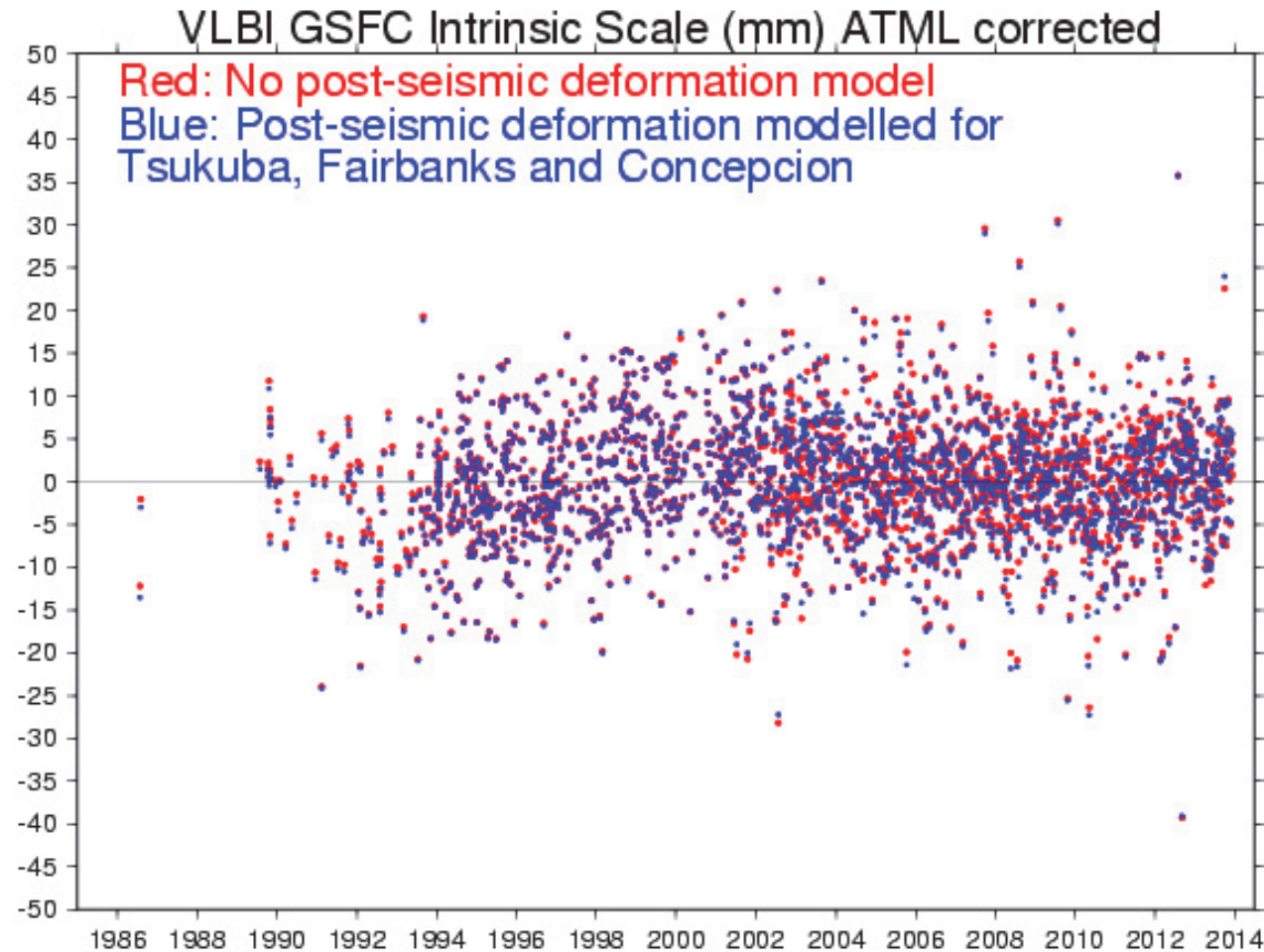
IDS D03v0 Intrinsic Origin&Scale



VLBI/GSFC2011b Intrinsic Scale



VLBI/GSFC2011b Intrinsic Scale



Weighting of LT and equating Velocities

- **Weighting of Local Ties:**

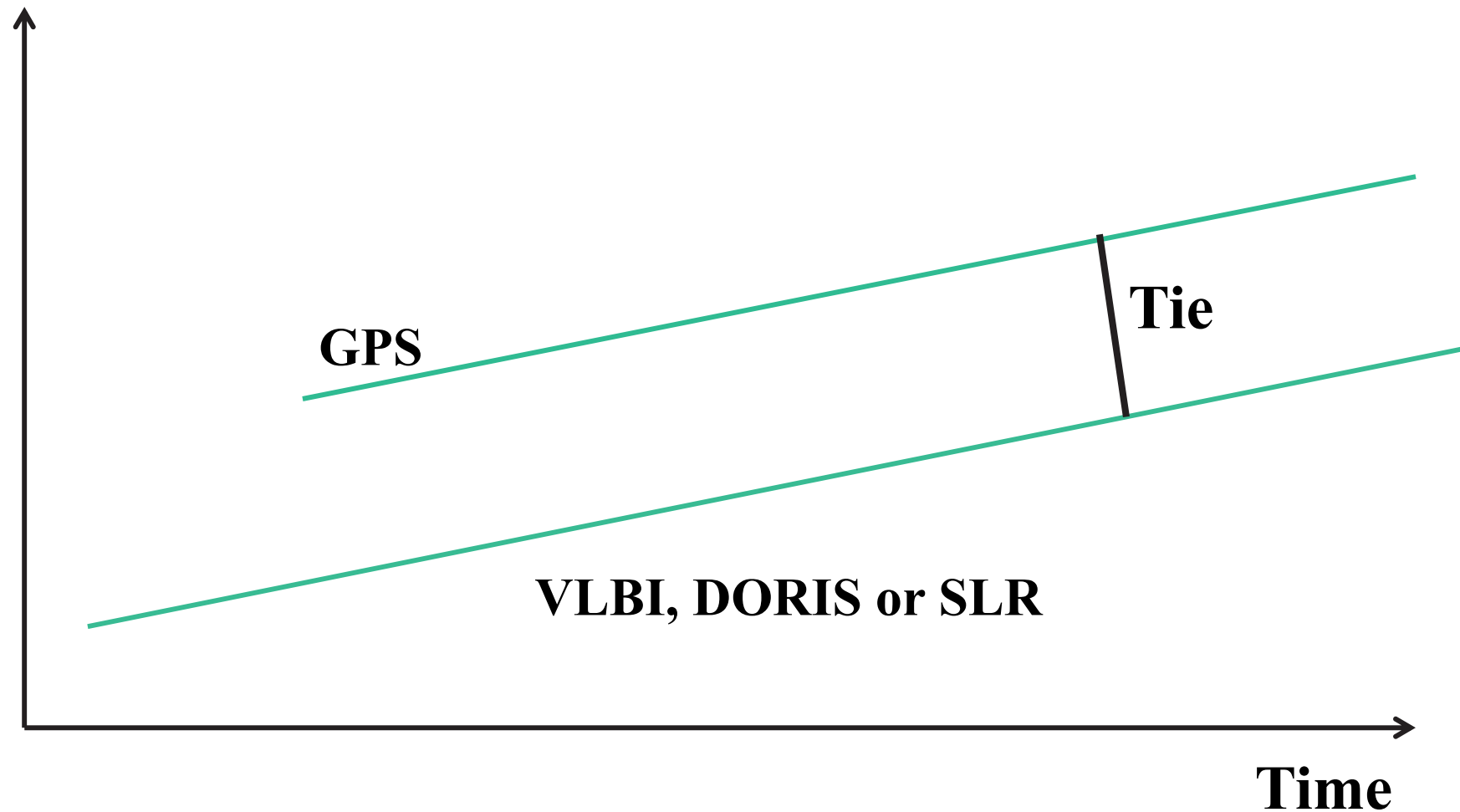
- Use of SINEX files
 - Use a variance factor per LT SNX, with 3 mm lower bound sigma
 - Weighting as a function of LT and SG agreement
- ==> down-weighting discrepant ties (normalized residual > 3), iteratively**

- **Velocity equalities at co-location sites:**

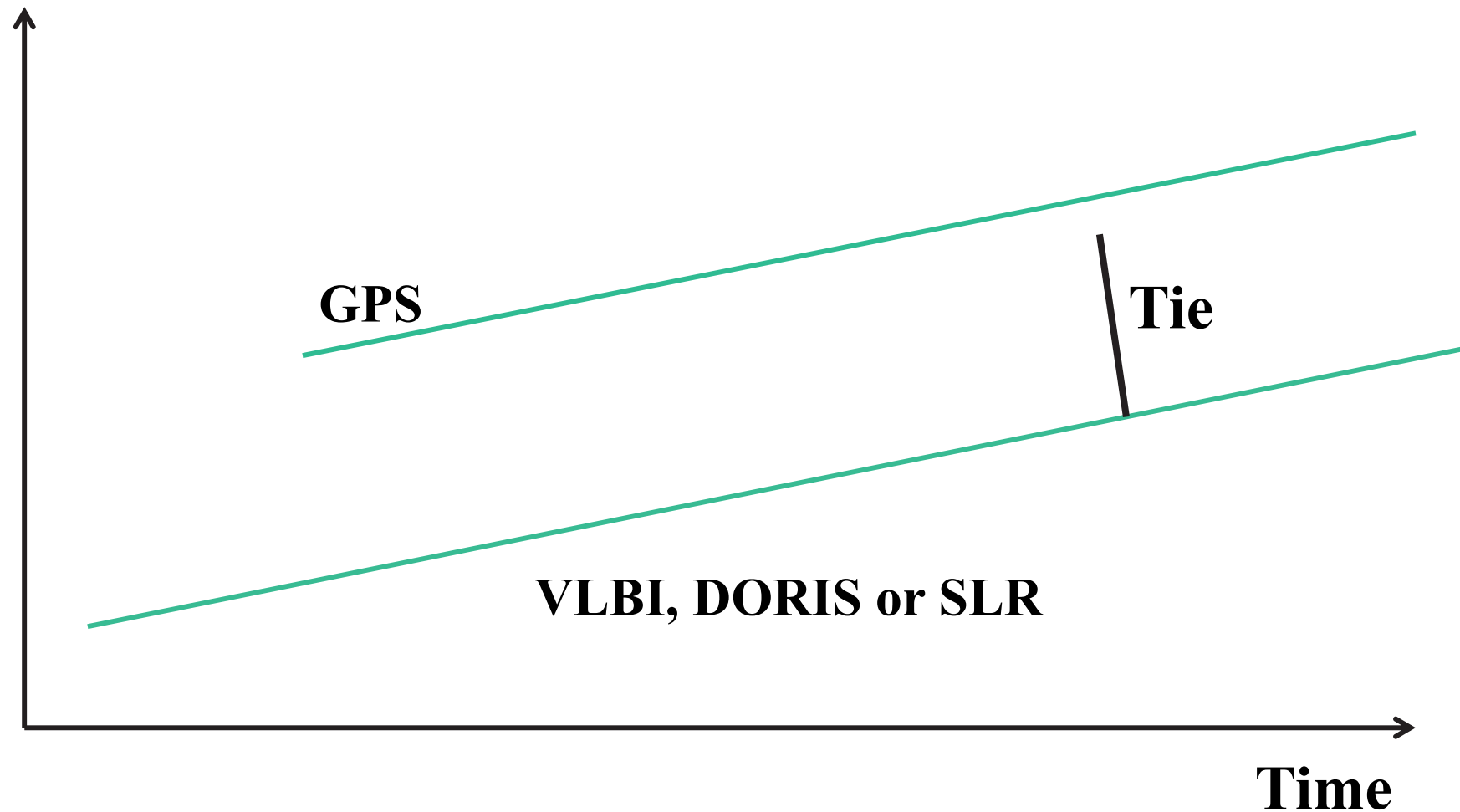
$$\dot{X}_i = \dot{X}_j \quad (\sigma)$$

- **Increase σ as a function of technique discrepancy, i.e. (normalized residual > 3)**

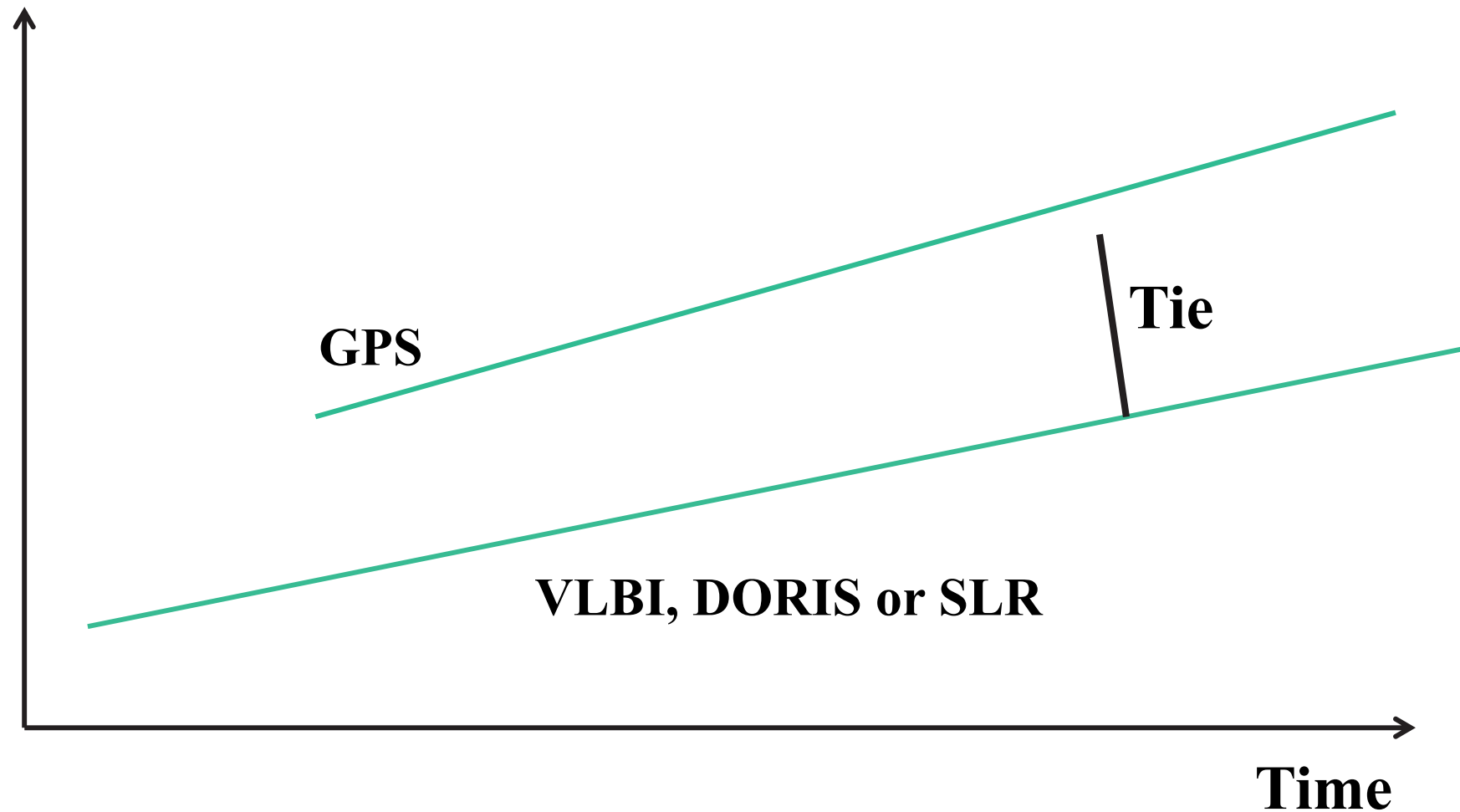
Schematic of velocity discrepancy at a co-location site



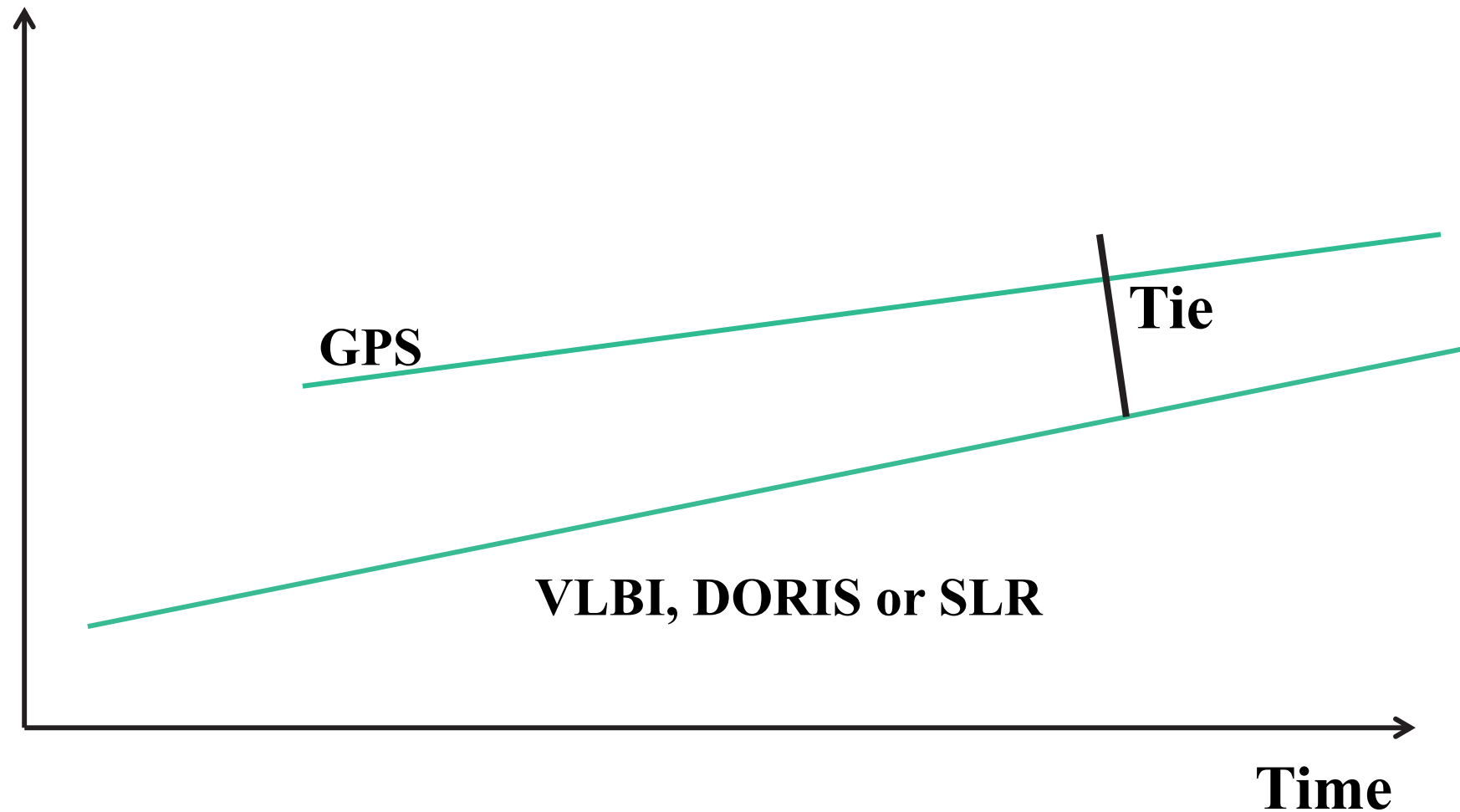
Schematic of velocity discrepancy at a co-location site



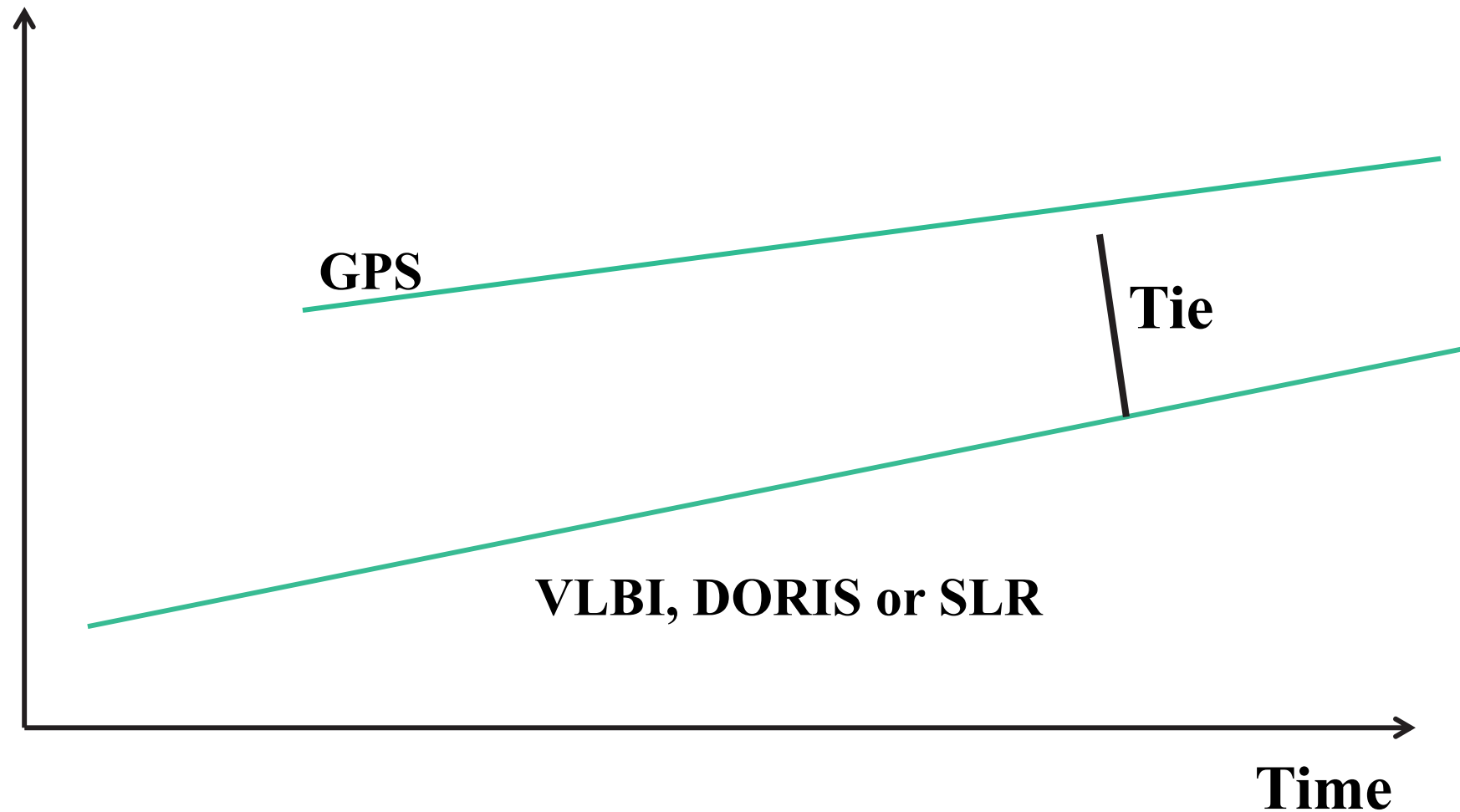
Schematic of velocity discrepancy at a co-location site



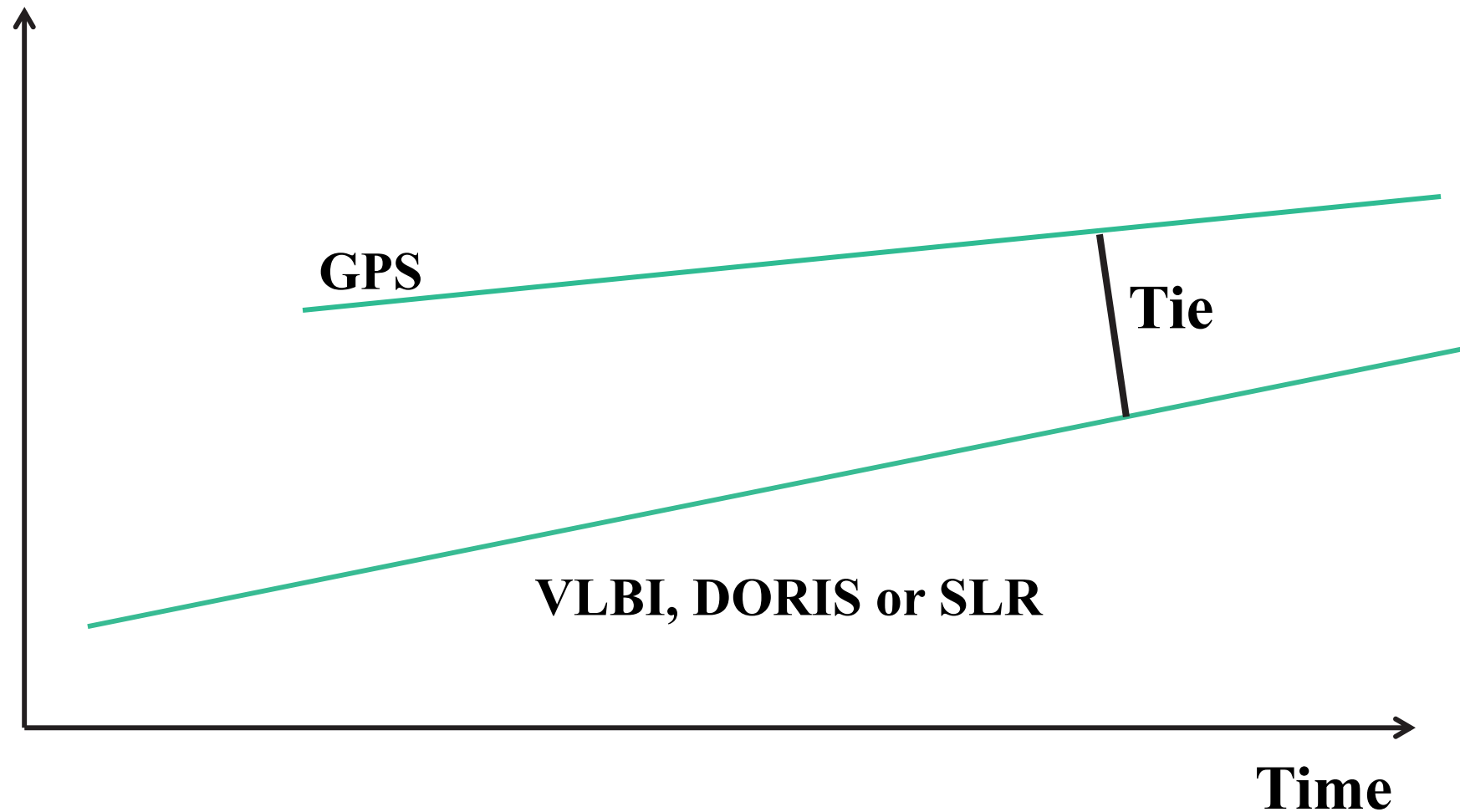
Schematic of velocity discrepancy at a co-location site



Schematic of velocity discrepancy at a co-location site



Schematic of velocity discrepancy at a co-location site



Uncertainties of local ties

Yarragadee: Scaling factor of the var-cov matrix = 21.2

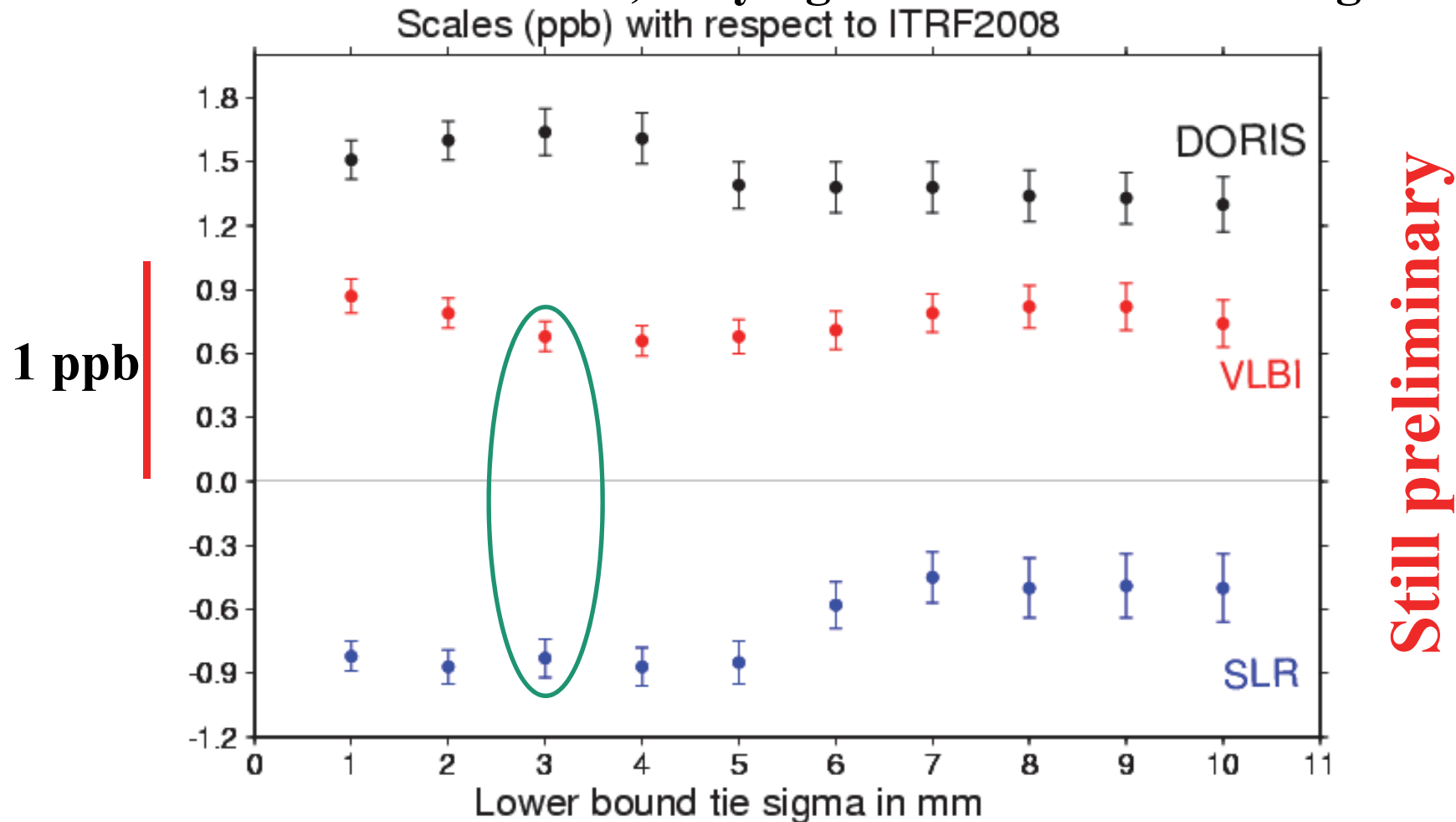
50107M004	1	50107M001	1	18.6136	12.4655	5.8449	YAR2 7090
± in X, Y, Z				0.0049	0.0040	0.0030	
± in E, N, Up				0.0049	0.0024	0.0045	

Mt Stromlo: Scaling factor of the var-cov matrix = 13.5

50119S003	1	50119M001	1	-10.1034	-23.0394	-0.1910	7825 STR2
				0.0045	0.0030	0.0060	
				0.0024	0.0065	0.0042	
50119M001	1	50119M002	1	-27.9473	27.6238	58.3016	STR2 STR1
				0.0077	0.0054	0.0144	
				0.0021	0.0170	0.0009	

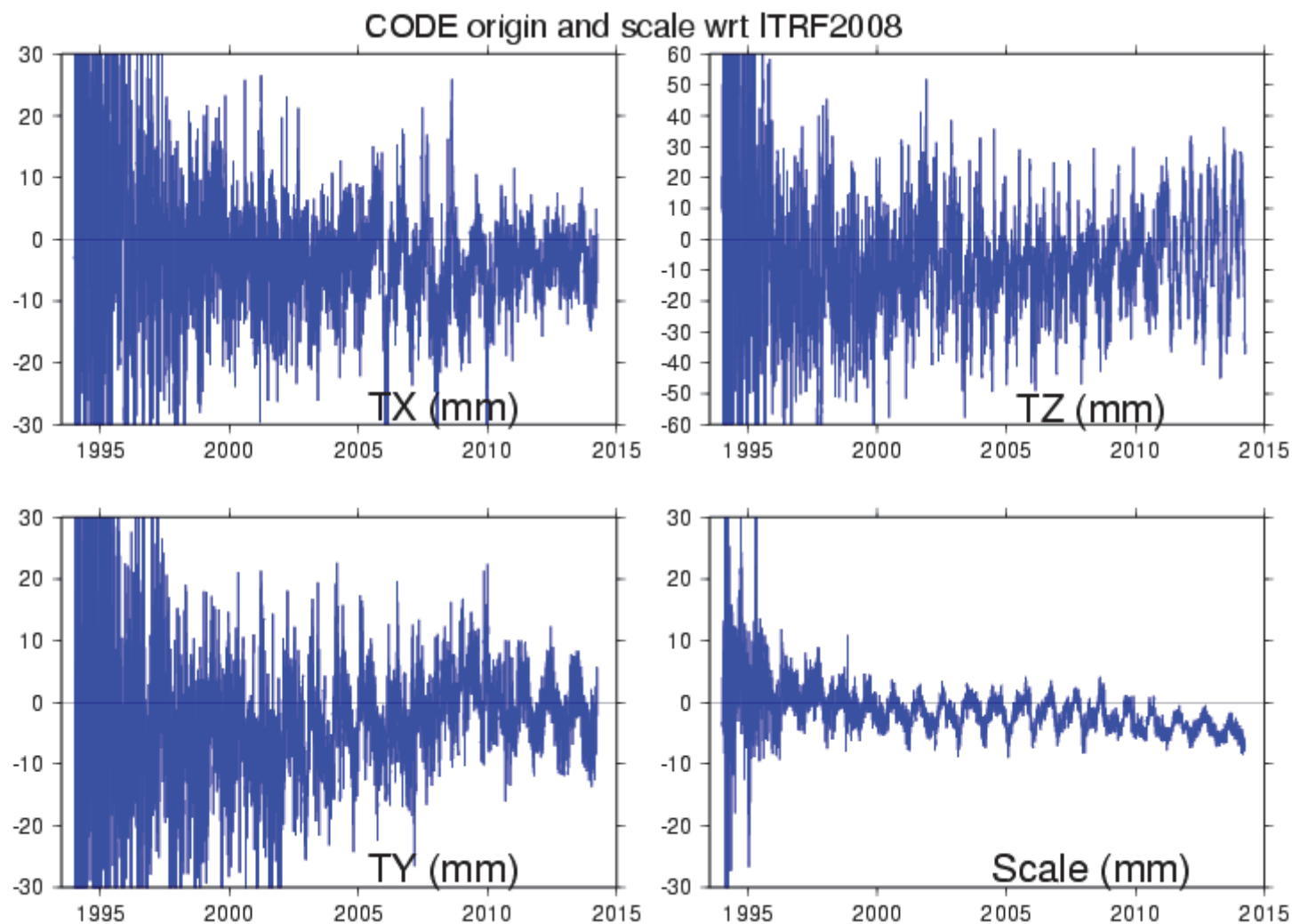
Scale Factors of VLBI, SLR & DORIS wrt ITRF2008

Ten combination tests, varying the lower bound tie sigma

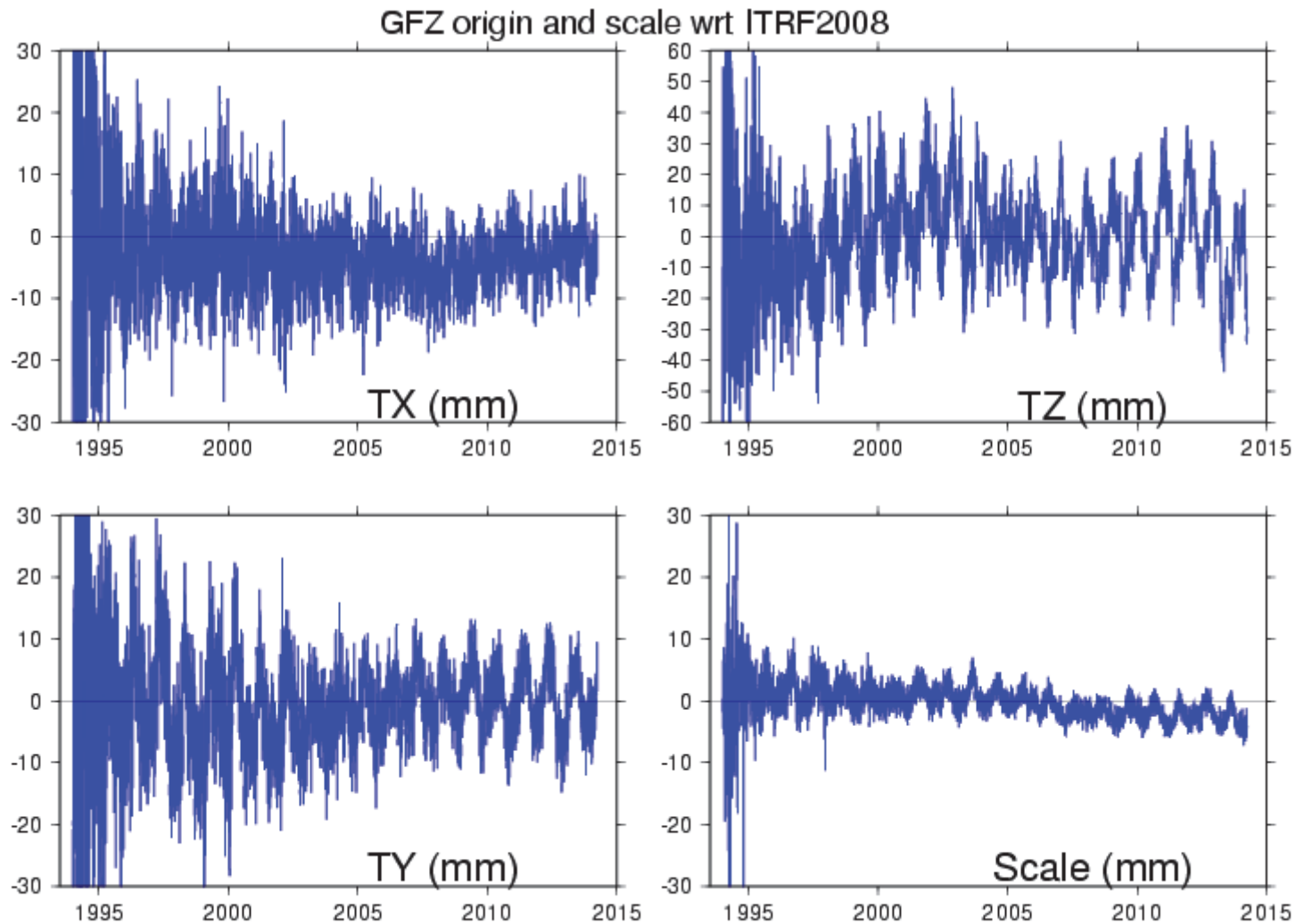


3 mm as lower bound tie sigma is used in this analysis

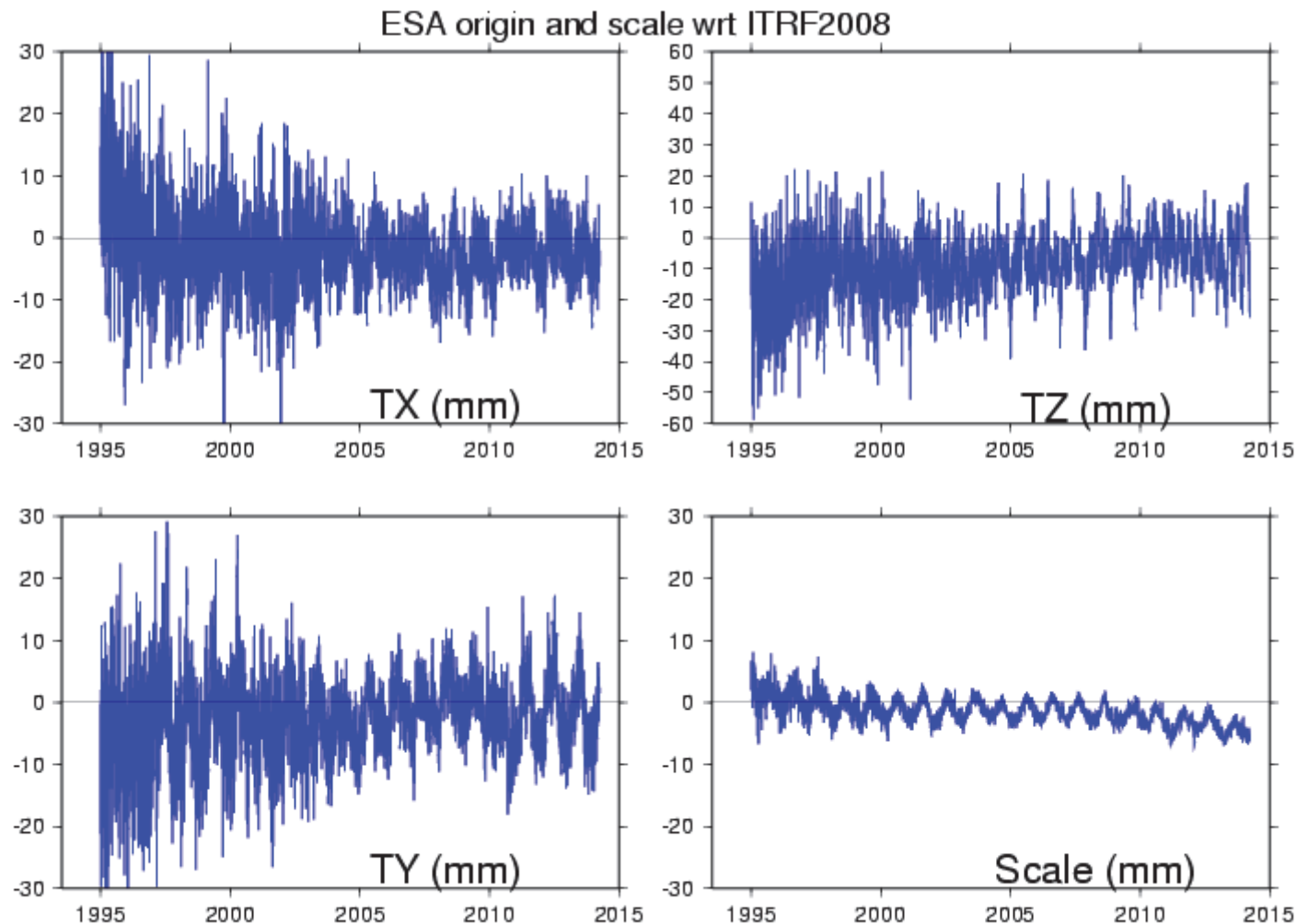
CODE Repro2 Origin & Scale wrt ITRF2008



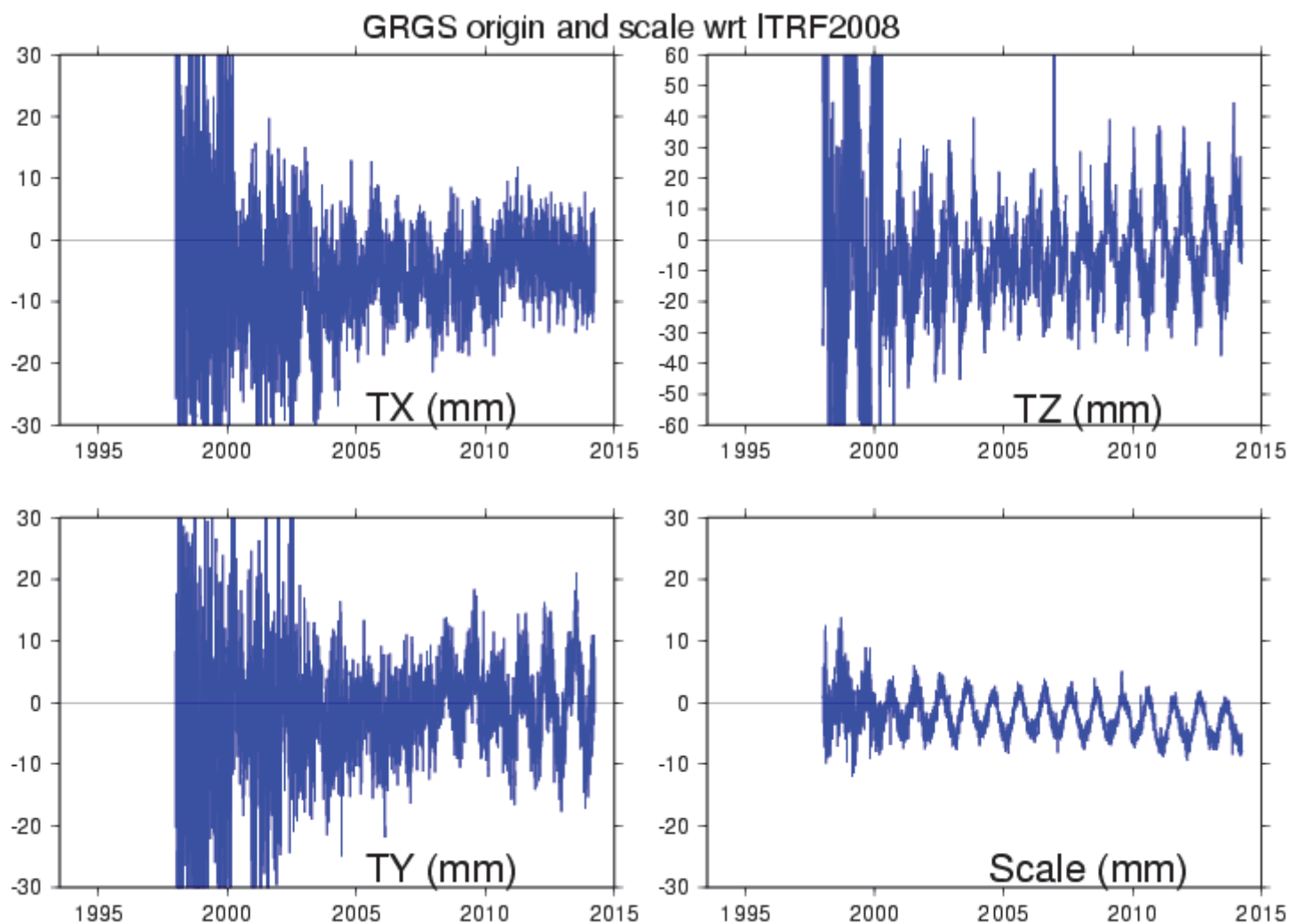
GFZ Repro2 Origin & Scale wrt ITRF2008



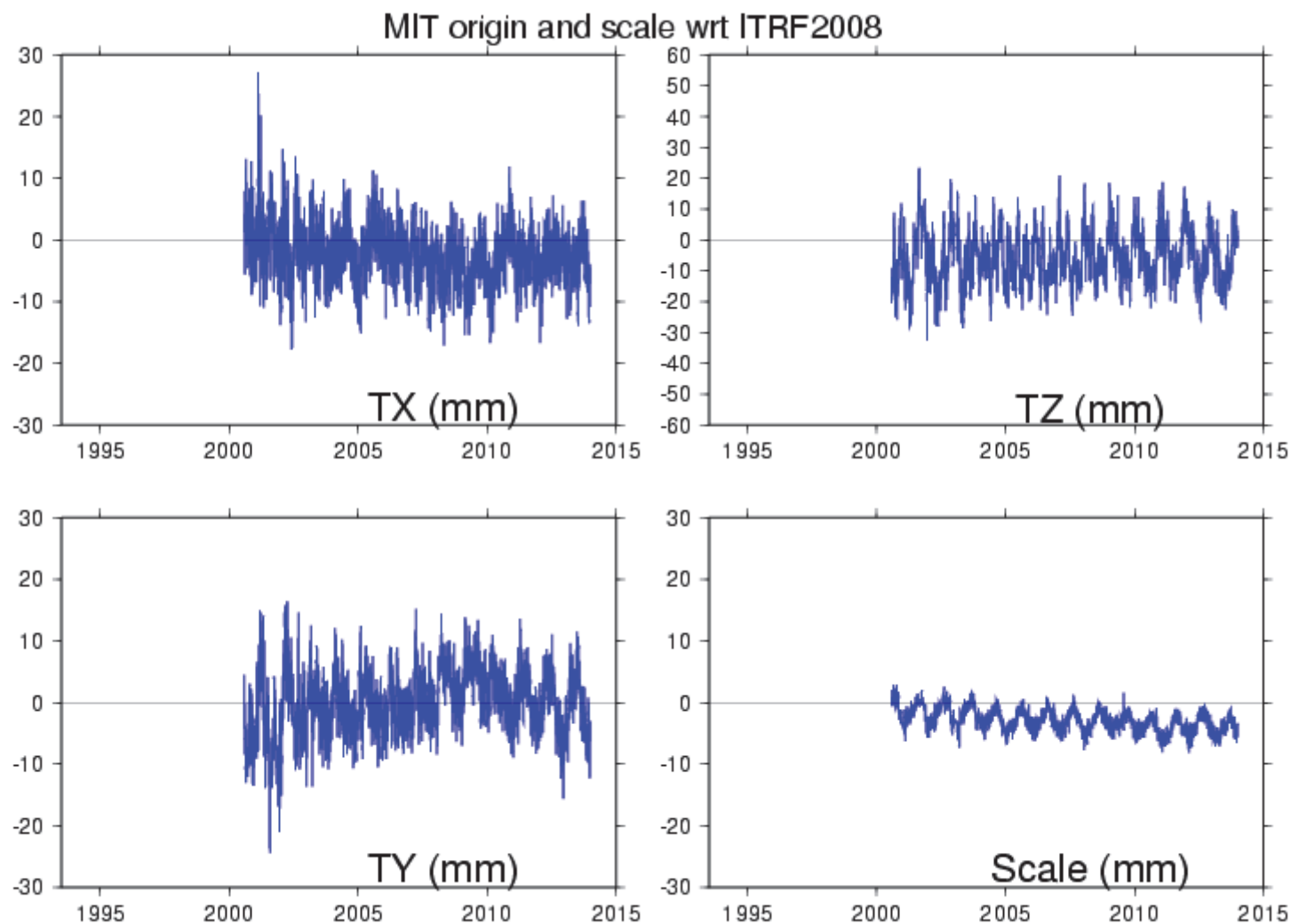
ESA Repro2 Origin & Scale wrt ITRF2008



GRGS Repro2 Origin & Scale wrt ITRF2008



MIT Repro2 Origin & Scale wrt ITRF2008



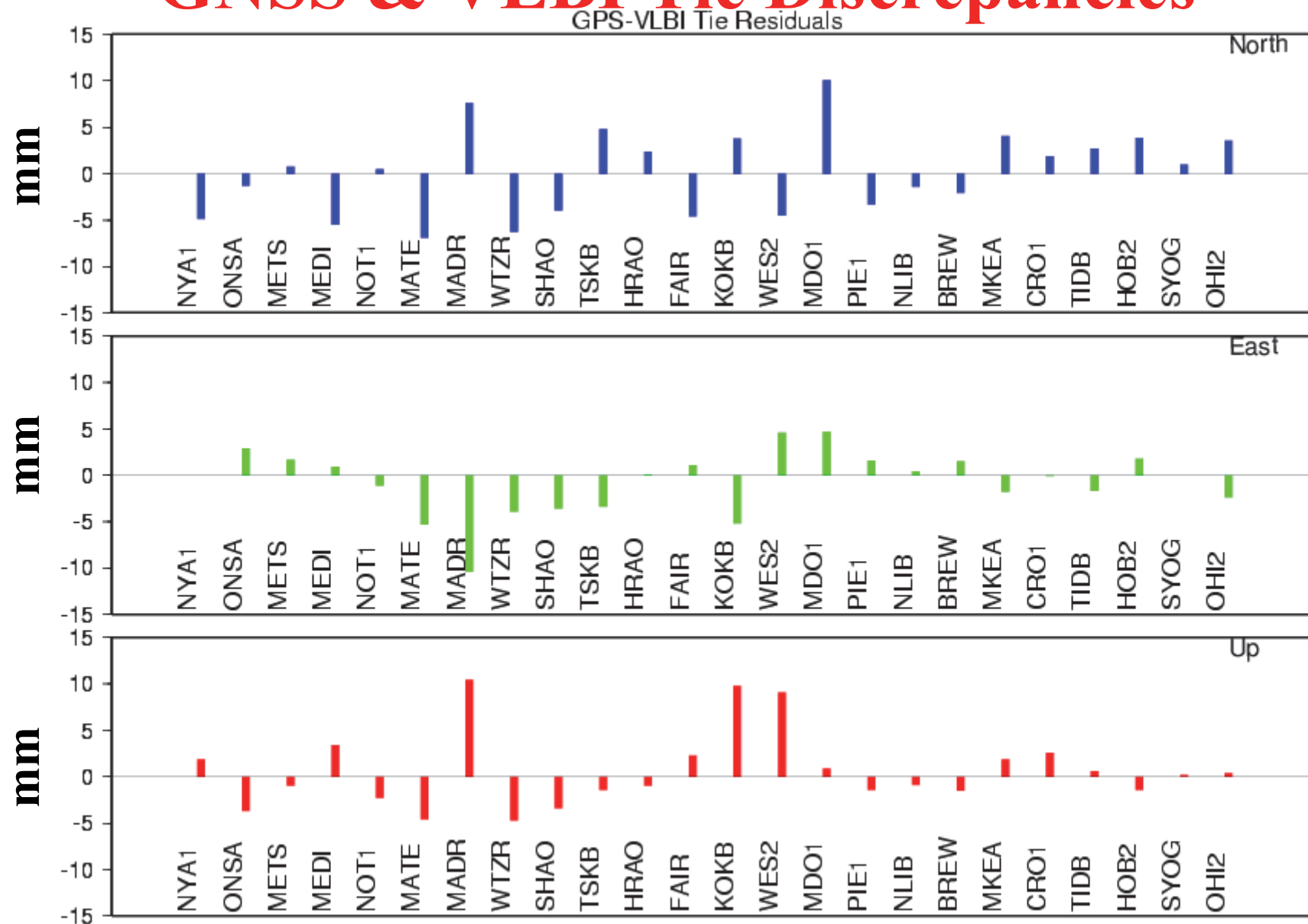
Summary

- Current estimate of the scale bias (δ) between VLBI and SLR is:

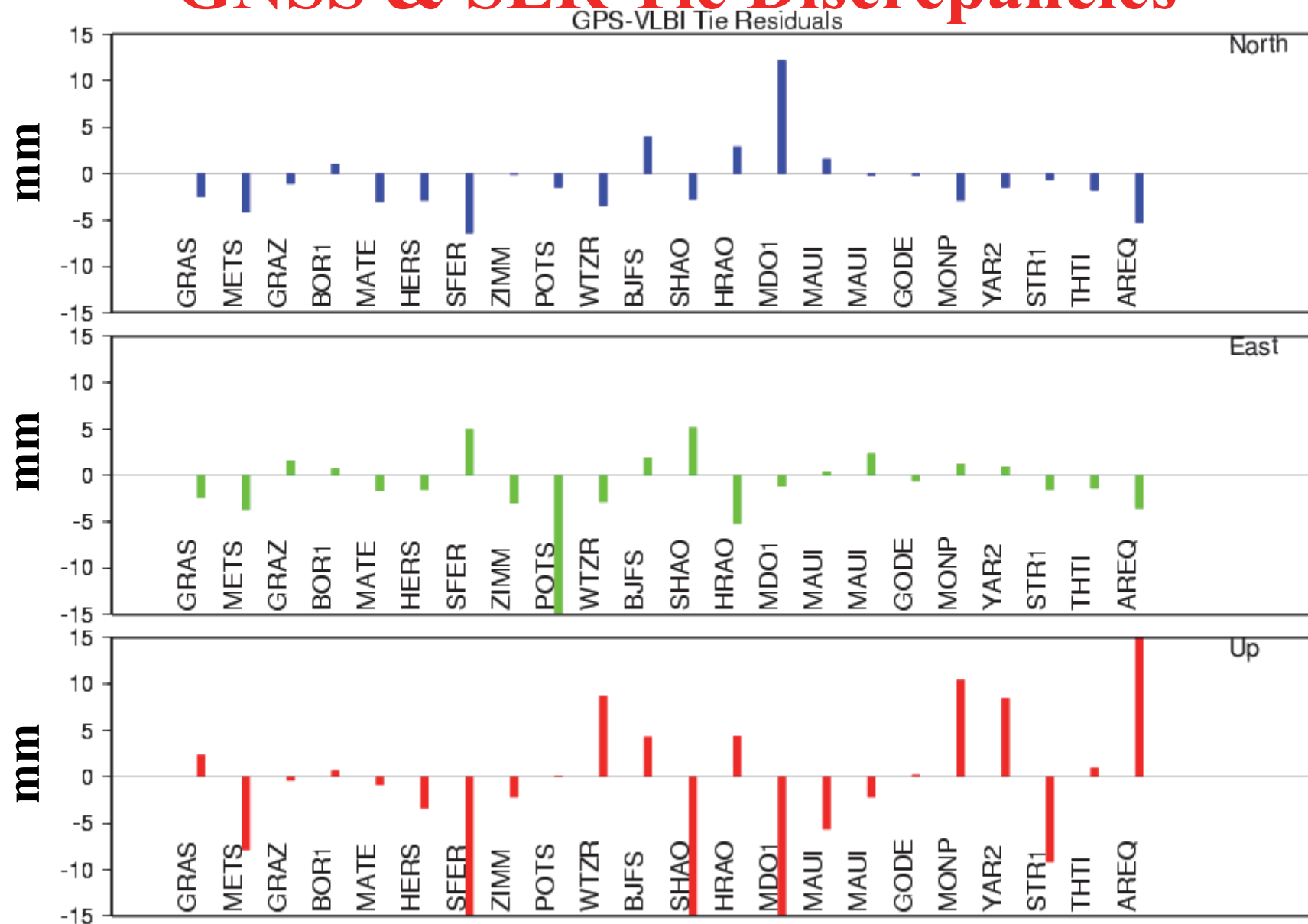
$$1 \leq \delta \leq 1.5 \quad \text{ppb}$$

- DORIS : $\sim +1.5$ ppb wrt ITRF2008
- IGS/GNSS: in average, wrt ITRF2008:
 - Offset = ~ -2.0 mm
 - Rate = ~ -0.2 (± 0.2) mm/yr $\approx$ (Collilieux & Schmid, 2012)
- For ITRF2013:
 - Repeat test combinations by varying the weighting of LT and velocity equality as new ties will be available
 - The significance of the scale drift will be statistically evaluated

GNSS & VLBI Tie Discrepancies



GNSS & SLR Tie Discrepancies



GNSS & SLR Tie Discrepancies

