

On the contribution of global, local, and tropospheric ties to TRF and CRF in GNSS and VLBI integrated solution

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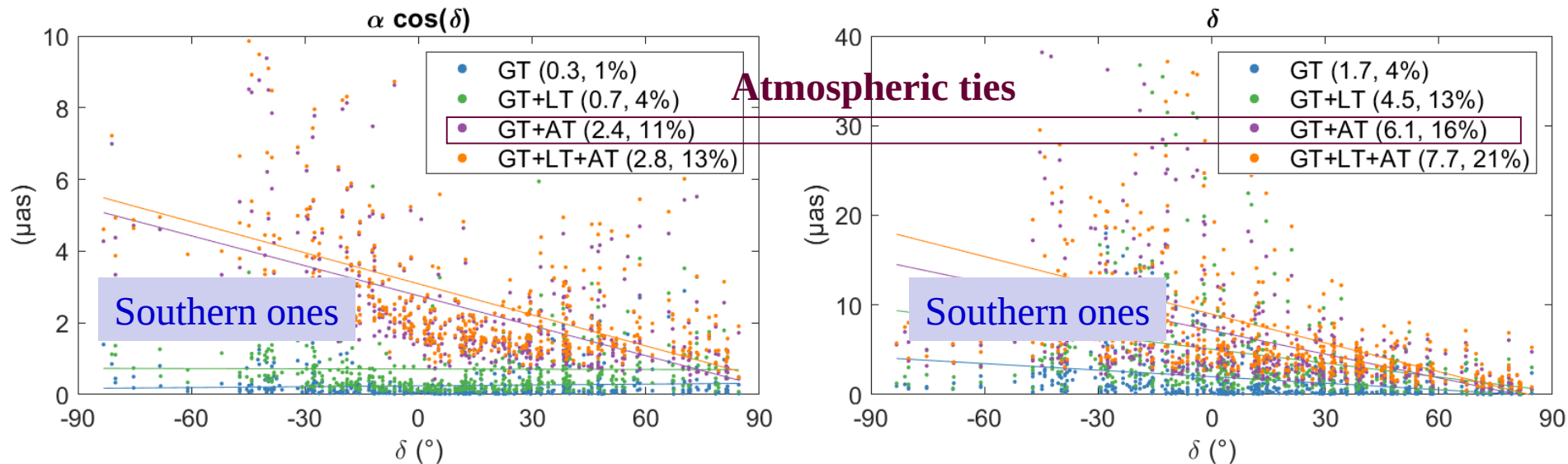
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GNSS and VLBI Combination on the Observation Level

- Target: consistent determination of TRF, CRF, and EOP from space geodetic technique (GNSS, VLBI, SLR) **combination on the observation level**
- Platform: Positioning And Navigation Data Analyst (PANDA)
 - Multi-GNSS, LEO, orbit and clock determination, precise positioning
 - **VLBI and SLR recently implemented**
- This study: GNSS and VLBI integrated solution
 - CONT05-CONT17 as an illustration
 - Applying global, local, and tropospheric ties
 - Impact on TRF (station coordinates), **CRF (AGN coordinates)**, and EOP

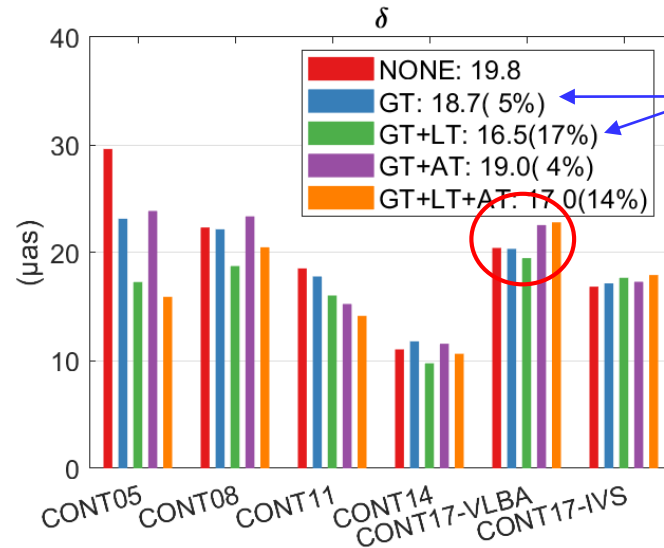
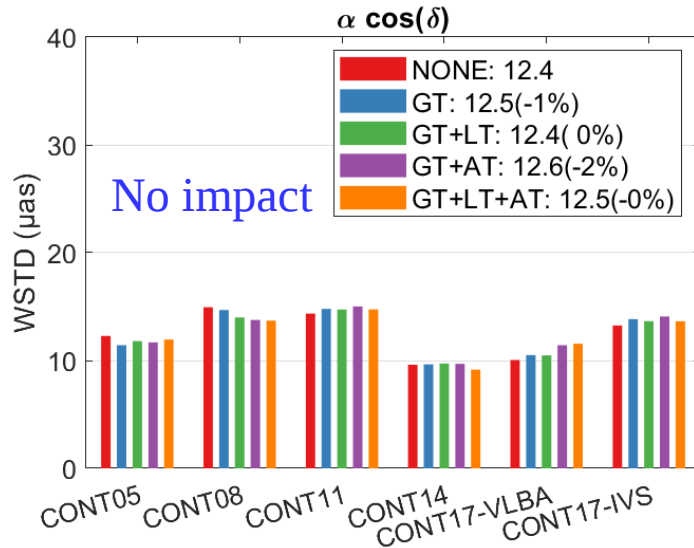
CRF Precision: AGN Coordinate Formal Error

- Reference solution “NONE”: GNSS and VLBI in one estimator, no ties applied
- Test of global ties (EOP, GT), local ties (LT), and atmospheric ties (AT)



CRF Precision: AGN Coordinate Repeatability

- Weighted repeatability (WSTD) in each CONT campaign
- Averaged value in legend (with improvement in %)



Improved by
global ties &
local ties

Negative impact of
tropospheric ties
**Optimizing
AT modeling?**
(backup slide)

Thank you for your attention!

Any questions?

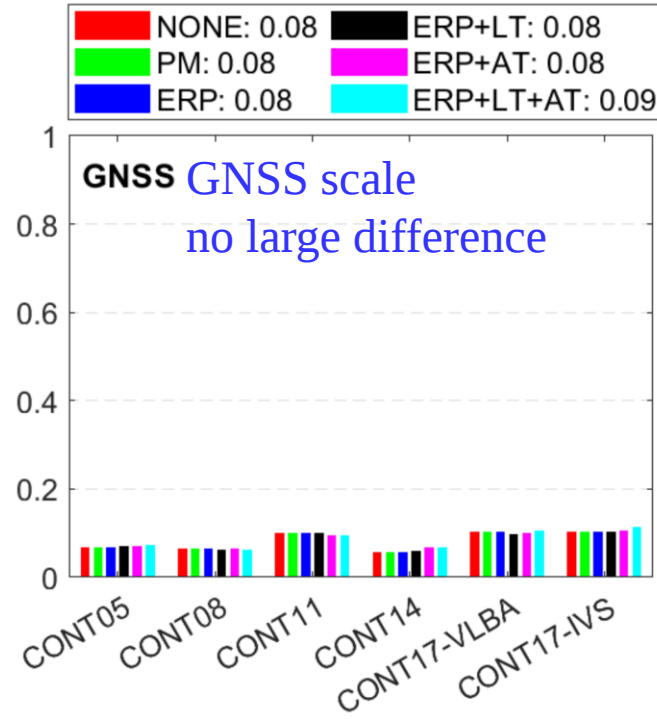
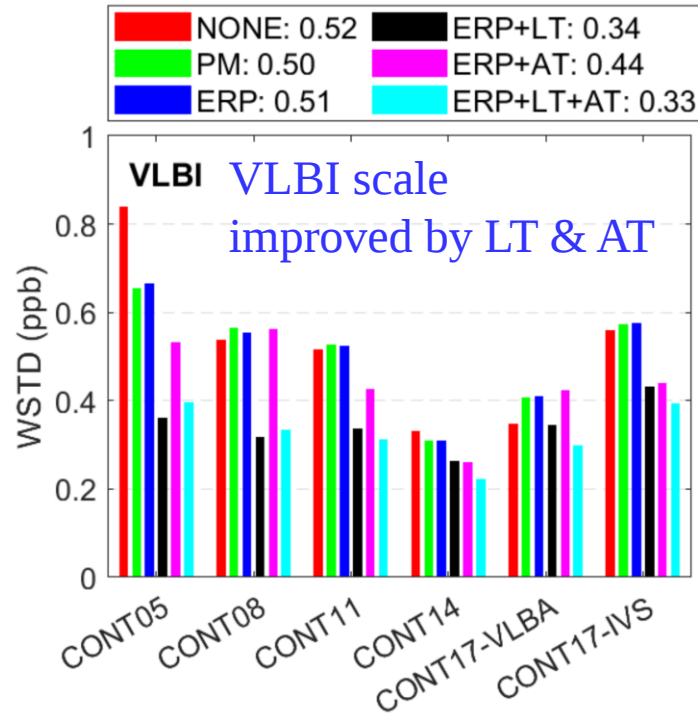
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<http://dx.doi.org/10.14279/depositonce-12513>

Wang, J., Ge, M., Glaser, S. et al. *Improving VLBI analysis by tropospheric ties in GNSS and VLBI integrated processing. J Geod 96, 32 (2022).* <https://doi.org/10.1007/s00190-022-01615-y>

Backup Slides

TRF: Scale Repeatability



Atmospheric Ties (AT): Impact of Constraints

➤ NO: no tropospheric ties

➤ NWM_{σ=0.01mm}

$$ZH_{GNSS} - ZH_{VLBI} = \Delta ZH_{NWM}$$

$$ZW_{GNSS} - ZW_{VLBI} = \Delta ZW_{NWM}, \sigma = 0.01mm$$

➤ NWM+BIAS_{σ=STD}

$$\left. \begin{aligned} \Delta ZW_{avg} &= avg(ZW_{GNSS} - ZW_{VLBI}) \\ \Delta ZW_{std} &= std(ZW_{GNSS} - ZW_{VLBI}) \end{aligned} \right\} \text{Single technique solution per CONT}$$

$$ZW_{GNSS} - ZW_{VLBI} = \Delta ZW_{avg}, \sigma = \Delta ZW_{std}$$

➤ NWM+BIAS_{est}

Daily constant parameter

$$ZW_{GNSS} - ZW_{VLBI} = \Delta ZW$$

