Validation of tropospheric ties at the test setup GNSS co-location site in Potsdam

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Introduction

- **Tropospheric ties**
  - Expected differences between atmospheric parameters at co-located stations
  - **Improve** the combination of space geodetic techniques[1]
    - Along with local ties and global ties
- **Are biases only come from height differences?**
  - Instrumental effects were founded in GNSS. (Kitpracha et al. 2020)
- **What else could affects GNSS atmospheric delays?**

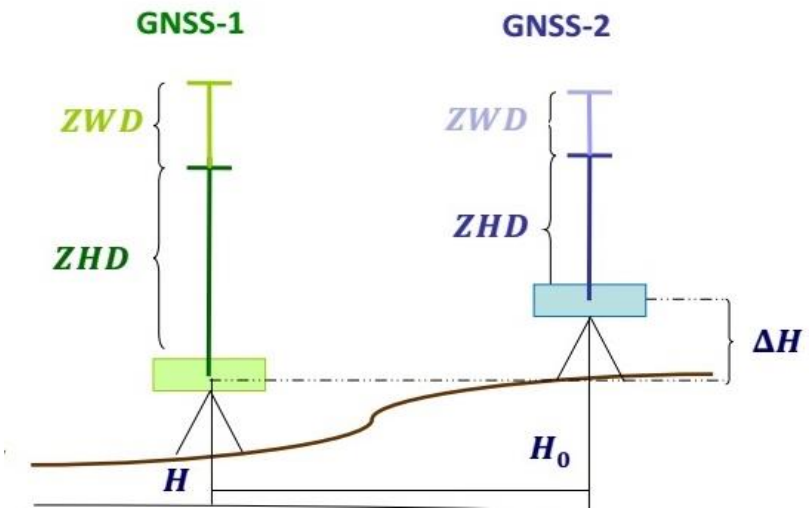


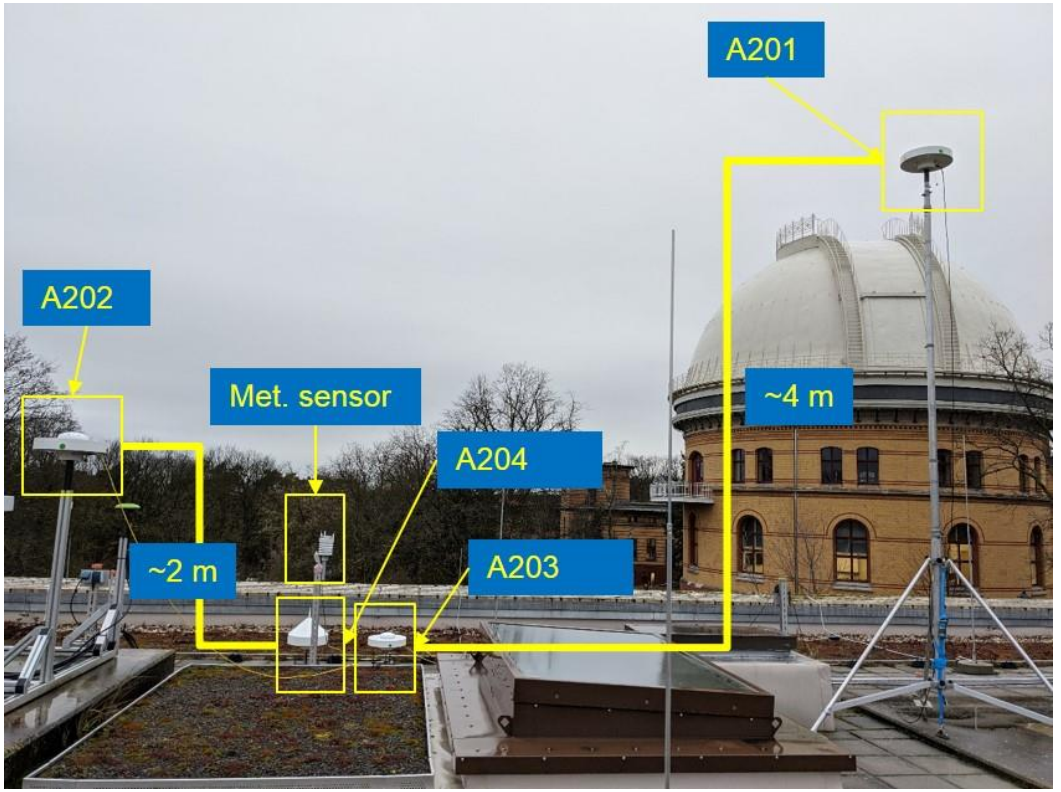
Fig. 1: Co-located GNSS antennas (Heinkelmann et al., 2016)

1: IAG JWG 1.1.1 Term of References ftp://ftp.gfz-potsdam.de/pub/home/kg/kyriakos/iag_jwg_atmospheric_ties/

An experiment set-up

- Using same antennas and receiver (Septentrio)
- Start from 31st January 2020 to 7th March 2020
- A203 and A204 located at the same height level
- *A204 equipped with RADOME
- Met. Sensor was installed (3.05 meters height differences w.r.t. A201)

- **Tropospheric ties**
  - **Analytical equation**
    - GPT3 (T1)
    - ERA5 (T2)
    - In situ (T3)
  - **Ray-traced** (T4)

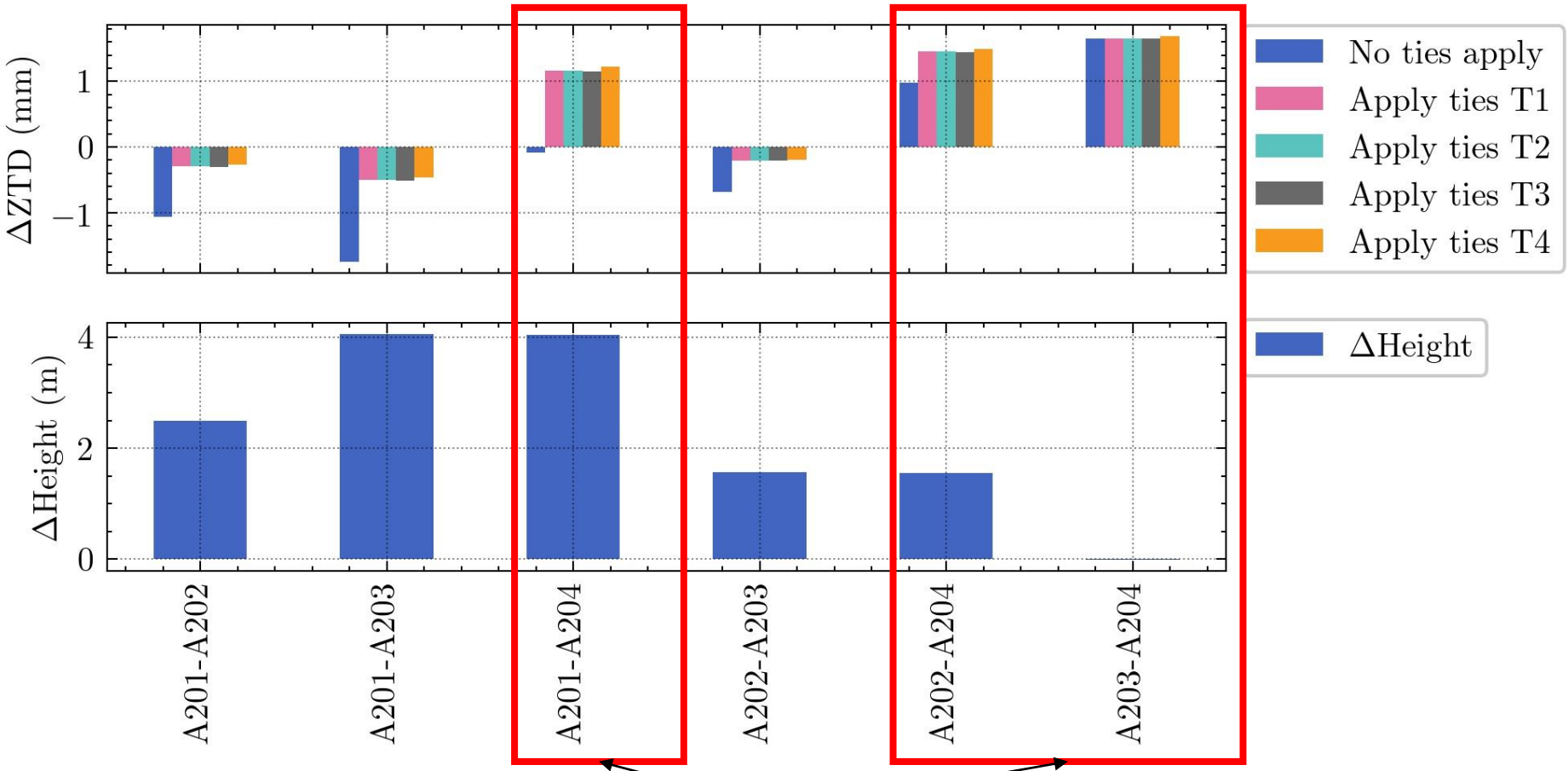


GNSS processing scheme

- Precise Point Positioning (PPP) mode with GFZ in-house EPOS.P8 software
  - GFZ Final orbit and clock products
  - Ionosphere free linear combination observations (L3)
  - Estimated daily station coordinates
  - Estimated hourly ZTD and horizontal gradients
  - Estimated epoch wise clock parameters
  - The sampling rate is five minutes

Results

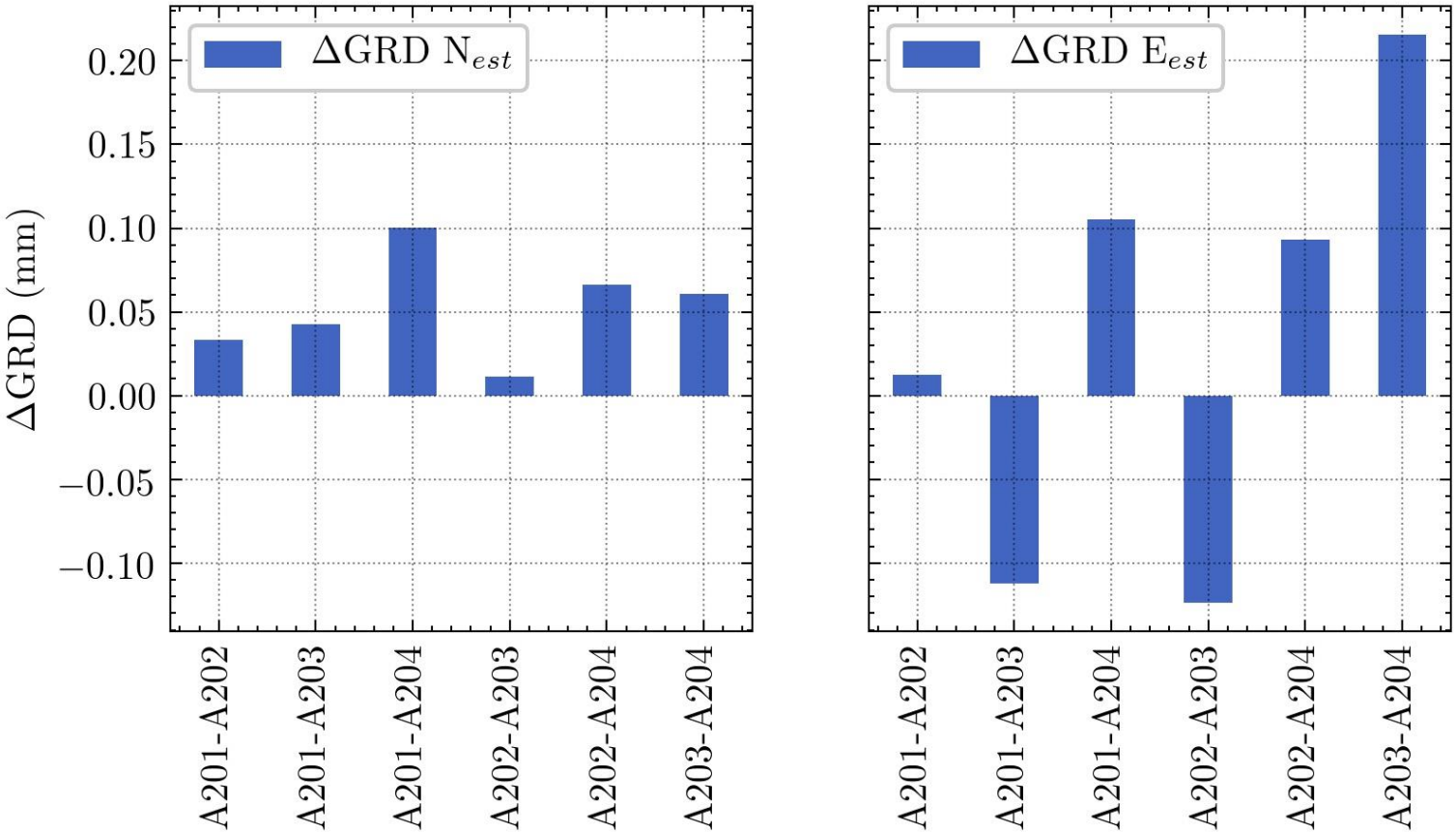
- ZTD comparison along with height differences
  - Mean differences over the course of the entire experiment



The unexpected biases!!!

Results

- Gradients comparison
  - Mean differences over the course of the entire experiment



Conclusions

- Only theoretical height bias was found. (No instrument bias)
- Radome causes an unexpected effects in GNSS tropospheric delays.
- Multipath in low-elevation obs. effects the gradients.
- Tropospheric ties shows similar performance
  - GPT3
  - ERA5 NWM
  - In situ
  - Ray-tracing
- This conclusions apply only for small height differences.

- Full details of this experiment could be founded in
  - AMT, Chaiyaporn Kitpracha, amt-2021-87 "Validation of tropospheric ties at the test setup GNSS co-location site Potsdam" by Chaiyaporn Kitpracha et al., in review

References

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