

Atmos. Meas. Tech. Discuss., referee comment RC1  
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## Comment on amt-2022-238

Anonymous Referee #1

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Referee comment on "Validation of tropospheric ties at the test setup GNSS co-location site in Potsdam" by Chaiyaporn Kitpracha et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-238-RC1>, 2022

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### General Comments

This is an extended version of the discussion paper / preprint <https://doi.org/10.5194/amt-2021-87> which was not published.

It is true that atmospheric ties is an important subject. This is already accepted by the community. The authors should stress what new knowledge this study offers to the community. It is trivial to correct for the extra 2-4 m height difference of nearby antennas. A reasonably good guess of the ground pressure is sufficient. This is shown in Tables 2 and 5 where the only significant impact is when no correction at all is carried out. All models give the same result given the uncertainties. It seems likely that the different biases seen in the ZTD between the different antenna installations are caused by uncertainties in the phase centre of the antenna which indirectly is affected by electromagnetic environment, such as multipath and radomes. "Multipath ties" or "antenna environment ties" would be a better description of what needs to be studied. Although the part covering the so called A20 experiment is correct and readable, it is not meaningful..

One issue in the 2021 preprint was the five weeks long time series of the A20 experiment (called A20) and that a much longer time series would open up for more detailed studies of long term stability, multipath etc. A second experiment (called A17), roughly eight weeks long is added to the old one in this manuscript. This new experiment does, however, use other antenna installations. The criticism of using short time series is still there.

### Specific comments

Unclear statements in the abstract:

"Additionally, multipath effects at low-elevation observations degraded the tropospheric gradients."

On the other hand on Line 211 you mention that the error increases for higher elevation cutoff angles?

"we set up another experiment with three GNSS stations and four different antennas"

This statement is confusing if you do not explain that you change antennas at a specific station.

"... and tropospheric gradients agrees with the result of the previous experiment in this study."

In what sense to they agree, when it is different gradients during different time periods?

As mentioned above all models applying a correction for troposphere (S1-S4) result is the same value. When the height differences are as small as 2 m and 4 m it is sufficient just to use the pressure. A potential improvement, for larger height differences, would be knowledge of the vertical gradient in the wet refractivity, which none of these models take into account. Therefore, the focus shall be on multipath models rather than on the method for tropospheric ties.

For example Figure 1 shows that there are metal structures both to the left and to the right of the A203 and the A204 antenna installations. What is the impact of these? One may, for example, remove A201 for a month and compare the offsets between the other three antennas, and then do same analysis removing A202 for one month.

This may be a relevant explanation to the effect mentioned in the last sentence in the caption to Figure 8?

Along the same lines, A203 and A204 are located very close to each other. Both are manufactured in metal and one issue to investigate at what level they affect each other?

The conclusion would benefit from being much shorter. The text in the section is more like a discussion of the results.

One sentence in the conclusion:

"In comparison to zenith delays, the parameterization of gradients a longer time intervals should be applied."

is difficult to understand. Do you mean that the gradients shall not be updated as frequent as the ZTDs in the estimation process? If so, why? The large gradients are typically caused by variations in the water vapour vapour that are short lived.

## Technical Corrections

Pages 9 and 12, Figures 3, 4 and 5 have problems with axis labels and legends.