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Interactive comment on "Benchmark campaign and case study episode in Central Europe for development and assessment of advanced GNSS tropospheric models and products" *by* J. Douša et al.

Anonymous Referee #1

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This is a very fine overview article, providing a short overview of the GNSS4SWEC ES 1206 Cost action, an extensive, detailed overview of the selection and handling of data for the GNSS4SWEC benchmark campaign, and some first results from the inter comparisons of GNSS and NWP derived ZTDs and ZTD gradients.

It is clear the benchmark data have been carefully screened and processed, providing a very useful dataset for further studies. Among the most interesting results are that GOP and GFZ results agree well (network versus ppp), that higher resolution NWP seems ot agree better with the GNSS, and that GFS NWP is biased with respect to the

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other solutions.

The the NWP community the finding of significantly larger gradients from the GNSS processing than found in NWP is very interesting, and potentially useful as an added data source. Likewise the finding that in certain situations the contribution from liquid water and ice is not negligible (estimated from NWP based calculations).

In my view the manuscript is almost ready for acceptance. I would recommend correct points 1 and 3 below before acceptance, while point 2 might be better suited by an online comment from the authors, given that this type of manuscript does not contain many details.

A few more detailed comments.

1 Many places in the text a reference to section 0 is given. Presumably that's the annex (judging from the numbering of the equations there), but the annex has no number.

2 A bias for GFS ZTD is found. There could be several reasons, some of which are related to how the numerical integrator for NWP ZTD is made, regarding both interpolation (different vertical resolutions) and extrapolation (top of the model).

3 Equation 0.6, for the effect of the hydro meteors, contains numbers on the right hand side, which seem to call for units. Is what is called "mass content" of hydro meteors another word for their mass density?

Speaking about units there is on the other hand no need to provide units for the density, pressure, temperature and gas constants further up page 19, as long as no values are given for the constants in equations 0.4 and 0.5.

The idea to include the hydro meteor contribution in the NWP cost function (if the NWP contains the relevant parameters) mentioned in the conclusion, is interesting. It reality is is very complicated, since they are normally not variables in the same sense as specific humidity of the NWP, and the NWP can be far of regarding their size. But pointing out that hydro meteors do sometimes contribute significantly to what appears

otherwise to be ZWD is important.

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