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Interactive comment on "Comparison of GPS tropospheric delays derived from two consecutive EPN reprocessing campaigns from the point of view of climate monitoring" *by* Zofia Baldysz et al.

Anonymous Referee #1

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Review Comparison of GPS tropospheric delays derived from two consecutive EPN reprocessing campaigns from the point of view of climate monitoring Zofia Baldysz1, Grzegorz Nykiel1, Andrzej Araszkiewicz1, Mariusz Figurski1, and Karolina Szafranek1 1Military University of Technology, Faculty of Civil Engineering and Geodesy, Warsaw, Poland Correspondence to: Zofia Baldysz (zofia.baldysz@wat.edu.pl)

General Comments The manuscript aims to compare two ZTD time series both delivered by the Military University of Technology respectively in the framework of first and second European Permanent Network (EPN) reprocessing campaign. The comparison is done in terms of seasonal components and linear trends, i.e. from the point of view of climate monitoring. Overall, the description of the methodology is good. However,

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Discussion paper

I found the paper quite verbose as regard as the description of the obtained results. I had the feeling to get lost in the 'numbers', mainly in section 5. In the manuscript, with the exception of the Appendix, all the estimates are provided without related errors, which need to be added and considered for a correct interpretation of the results. There are several differences in the processing options applied to get MUT contribution to EPN Repro1 and Repro2 campaigns. Therefore, I agree with the authors, that it is difficult to separate the influence of each parameters. My suggestion is to add an evaluation/discussion of the obtained results against similar studies available in literature. The manuscript fits within the scope of the journal and the special issue providing a contribution to the activities carried out in the WG3 of the COST Action 'GNSS4SWEC'.

Below some comments / questions

Introduction Page 1 - line 24. Water vapor radiometer should be also consider.

Page 2 – line 3. Even if it is well known, the first time GPS is used the acronym has to be explained.

Page 2 – line 4. Please add after '. . ..task' 'thanks to the availability of 18 years of data'.

Page 2 – line 7.'. . .high accuracy', please be more specific indicating the required accuracy.

Page 2 – line 10.'.. selected meteorological parameters', please be more specific indicating which are the meteorological parameters used.

Page 2 – line 15. For a discussion of the uncertainties, the following paper should be added Ning et al. 'The uncertainty of the atmospheric integrated water vapour estimated from GNSS observations" doi:10.5194/amt-9-79-2016

Page 2 – line 32. I suggest replacing 'The first of them came from the first EPN. . .' with 'The first of them was the MUT (Military University of Technology) contribution to the first EPN. . ..'

Page 2 – line 34. I suggest replacing 'The second one was obtained from the latest EPN reprocessing campaign (called here Repro2).' With 'The second one was the MUT contribution to the latest EPN reprocessing campaign'.

Page 3 – line 1. Designed?

At the end of the introduction, add a few sentences explaining how the paper is structured.

Analyzed Data Eq. 1 The first term is dtrop not ZTD

Eq.2 Replace 'k1 ' with 'k1 Rd ', being Rd the specific gas of the dry constituent (Rd = R=Md, R is the universal gas constant)

Page 3 – line 29. Add in Eq,4 the gradient components and cite MacMillan, D. S., Atmospheric gradients from very long baseline interferometry observations, Geophys. Res. Lett., 22, 1041-1044, 1995. Chen, G. and T. H. Herring, Effects of atmospheric azimuthal asymmetry on the analysis of space geodetic data, J. Geophys. Res., 102, 20,489-20,502, 1997 Bar-Sever, Y.E., Kroger, P.M., Borjesson, J.A., 1998. Estimating horizontal gradients of tropospheric path delay with a single GPS receiver. J. Geophys. Res. 103 (B3), 5019–5035.

Page 4 – line 2. To be more precise in the data processing ZTD is split into its hydrostatic and wet part. While the first is modelled, the second is estimated along with the other parameters.

Page 4 – line 5. My suggestion is to replace 'In this paper,. . .. . .compared' with 'In this paper, the MUT individual contribution to EPN Repro 1 and EPN Repro 2 reprocessing campaigns are compared'

Page 4 – line 7. Please be more specific on EPN. The EPN (EUREF Permanent Network, http://epncb.oma.be/) together with the UELN (United European Leveling Network) is the EUREF Key infrastructure. The IAG Sub-commission 1.3a EUREF (http://www.euref.eu) is a joint effort of European research agencies and National Map-

ping and Cartographic Agencies with the goal to define, realize, maintain and provide access to the European Reference Frame.

Page 4 – line 10. Replace ‘data’ with ‘solutions’ to avoid confusion with ‘data’ used in the previous sentence. The same for ‘data’ used in the sentence that follows.

Page 4 – line 21. Replace the sentence ‘The first major difference between Repro1 and Repro 2 was in software that was used’ with ‘The first major difference between MUT contribution to Repro1 and MUT contribution to Repro2 was in software that was used. Bernese 5.0 software (Dach et al., 2014) was used in Repro1 while GAMIT 10.5 software (King et al., 2010) for the Repro2 calculations.’

Page 4 – line 23. What is the relative approach?

Page 4 – line 33. Tregoning and Watson (Tregoning and Herring, 2006) ???

Page 5 – line 10. Typo ‘Viena’

Page 5 - Table 1 Typo at the second line of Repro2 campaign delete Gamit. What is about gradients, are they estimated or not?

Page 6 – line 9. Typo ‘shouldn’t’ ‘should not’

Page 6 – line 10. Could the author provide the percentage of the rejected data? For the ZTD data screening please consider the following paper Bock et al. A high quality reprocessed ground-based GPS dataset for atmospheric process studies, radiosonde and model evaluation, and reanalysis of HyMeX Special Observing Period 10.1002/qj.2701

Analysis of ZTD time series Page 7 – line 5. As regard as ‘For some of the analyzed stations ter-annual and even quarto-annual signals were found (e.g. MAS1 station).’ It would be interesting to know is the stations showing such signals have something in common for example are in the same geographical location.

Page 7 – line 8. ‘Their occurrence can be caused by various phenomena.’ Do you have

an idea of which phenomena?

Results of seasonal analysis Page 8 – line 10. Is the average value of the annual oscillation computed considering all the stations shown in Figure 1?

Page 9 – line 1. typo ‘the Netherlands’ ‘The Netherlands’

Page 9 – line 2. Is there any explanation why these 5 stations: DELF, HOFN, REYK, TERS, WSRT are an exception?

Page 10 – line 1.. As regard as the ZTD mean, is it computed on monthly basis, annual basis?

Results of trend analysis

Page 12 – line 2.Typo ‘BOR1’ ‘BOR1 (Poland)’

Page 12 – line 2. Is there any lat/lon dependence in the differences reported in Fig.6?
Page 13 – line 10. Typo ‘MATE (Spain)’ ‘MATE (Italy)’

Discussion Page 16 - line 5. Typo ‘VMF’ ‘VMF1’

Figure 10. Check the caption and the legend (RP1?,RP2?)

My suggestion is to add, in this paragraph, an evaluation/discussion of the obtained trends against similar studies available in literature. Moreover, throughout the manuscript the authors provide only the estimate of trend/mean/amplitude with no related error, which should be considered as well.

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