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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.

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The authors would like to thank Referee#1 for the comments. In respond to the comment, we changes most of points exactly as suggested by the referee. Any other answers and comments can be found below:

General comments:

- Referee#1: 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.

Authors: Description of obtained results has been changed. Detail 'Numbers' from section 5 were removed, due to the fact that they are easy to find in Figures as well as

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in appendix.

- Referee#1: 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.

Authors: In the beginning of the sections with results, general information about level of error and explanation of the size of errors, has been added. It explain, why we decided to skip it in the text.

- Referee#1 My suggestion is to add an evaluation/discussion of the obtained results against similar studies available in literature.

Authors: the discussion section has been expanded on the basis of the available literature, e.g. Ning and Elgered "Trends in Atmopsheric Water Vapour Content From Ground-Based GPS: The Impact of the Elevation Cutoff Angle" (2012), Tregoning and Herring "Impact of a priori zenith hydrostatic delay errors on GPS estimates of station heights and zenith total delays" (2006), Rothacher M. "Estimation of station heights with GPS" (2002), Thomas I.D. et al. "Precipitable water vapor estimates from homogeneously reprocessed GPS data: An intertechnique comparison in Antarctica" (2011), Vey S. "On the homogeneity and interpretation of precipitable water time series derived from global GPS observations" (2009),

Other comments/questions: - Referee#1 Introduction Page 1 - line 24. Water vapor radiometer should be also consider.

Authors: water vapour radiometer was added to the text. "There are several methods based on the results of measurements made by means of water vapour radiometers, radiosondes, sun photometers or satellite devices (e.g. GOME, GOME-2) which enable to determine the amount of water vapour in the troposphere (IWV, Integrated Water Vapour)"

- Referee#1 Page 2 – line 3. Even if it is well known, the first time GPS is used the

acronym has to be explained.

Authors: the acronym has been clarified. “Among them, GPS (Global Positioning System) observations have started to play a significant role in this task thanks to the availability of 18 years of data.”

- Referee#1 Page 2 – line 7: ..high accuracy’, please be more specific indicating the required accuracy.

Authors: accuracy of the estimation has been specified “Advanced processing of the GPS observations enables to determine its value with very high accuracy, below 2 mm (e.g. bock2016)

- Referee#1 Page 2 – line 10: selected meteorological parameters’, please be more specific indicating which are the meteorological parameters used.

Authors: phrase ‘selected meteorological parameters’ has been replaced ‘selected meteorological parameters (surface pressure and temperature)’ to be more specific

- Referee#1 At the end of the introduction, add a few sentences explaining how the paper is structured

Authors: According to referee suggestion, at the end of introduction following sentences (which explain how the paper is structured) have been added: ‘This paper is structured as follows. Section 2 and 3 described respectively data and methods used for analysis. Section 4 and 5 are related to the results of short term (seasonal components) and long term (linear trends) analysis. Consequence of them is given in section 6, where discussion about differences in obtained results is presented. Last section provides summary and conclusions of the performed analysis.’

- Referee#1 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.

Authors: sentence changed to “ZHD from the above formula is usually adopted from model, whereas ZWD is one of many unknowns which are estimated during position determination.”

- Referee#1 Page4 – 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 Mapping and Cartographic Agencies with the goal to define, realize, maintain and provide access to the European Reference Frame

Authors: we added ‘The EPN (www.epncb.oma.be) is a network of permanent GNSS stations built on the basis of and as a densification of the IGS global network (International GNSS Service) in Europe. Together with the UELN (United European Levelling Network), it plays a role of the EUREF Key infrastructure. The EUREF (www.euref.eu) is the IAG (International Association of Geodesy) Sub-commision and its main goal is to define, realize, maintain and provide the European Reference Frame (currently ETRS89 and ETRF2000). The EUREF is a joint, voluntary, effort of the many research agencies and National Mapping and Cartographic Agencies.’ to be more precise.

- Referee#1 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.

Authors: sentence ‘This resulted in collecting and archiving inhomogeneous sets of data which in consequence prevented from conducting proper analyses of long time series.’ changed to ‘This resulted in collecting and archiving inhomogeneous sets of solutions which in consequence prevented from conducting proper analyses of long time series.’ Similarly changes were introduced in case of ‘This ensured the maximum coherence during comparison of the data from these two reprocessing campaigns.’ which now is described as follows :’ This ensured the maximum coherence during

comparison of the solutions from these two reprocessing campaigns.'

- Referee#1 Page 4 – line 23 What is the relative approach ?

Authors:' relative approach' changed to 'network approach' to be more precisely

- Referee#1 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

Authors: we added information about percentage of the rejected data and detailed description of screening (by giving literature: 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): ' 'Therefore, ZTD data screening was conducted in both data sets: all outliners that exceed two standard deviations were removed' changed to 'Therefore, ZTD screening was conducted in both solutions sets, according to approach described by Bock et al. (Bock et al. 2015). For all the stations, the percentage of all rejected solutions was on the level of 0,42%. The largest number of rejected solutions was in case of SFER station and amounted to 4,18%. ' The previous version was simplified form of describing of screening process.

- Referee#1 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.

Authors: we added information about all stations which have this kind of oscillations and about their geographical location: " For some of the analyzed stations ter-annual (CASC, SFER, VILL, MAS1) and even quarto-annual signals were found (SFER, MAS1). All these stations are located in south-western part of analyzed net-

work (CASC, SFER, VILL) or in the Canary Islands, so probably the occurrence of some Atlantic currents affected them in such way.'

- Referee#1 Page 7 – line 8: 'Their occurrence can be caused by various phenomena.' Do you have an idea of which phenomena?

Authors: the reason for the prevalence of these oscillations is still under authors investigations. However authors decided to include information about them due to the fact that they occurrence seems to be significant compared to the others.

- Referee#1 Page 9 – line 2: Is there any explanation why these 5 stations: DELF, HOFN, REYK, TERS, WSRT are an exception?

Authors: The reason of exception these 5 stations (DELF, HOFN, REYK, TERS, WSRT) is that the differences in annual periods between results from Repro1 and Repro2 campaign were larger than 1 mm.

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

Authors: mean ZTD values were computed on the basis of hourly data from all of the analyzed period. In case of seasonal variability ZTD mean value based on monthly solutions would be taken into account, however in case of this study short time variabilities of ZTD were not considered.

- Referee#1 Page 12 – line 2: Is there any lat/lon dependence in the differences reported in Fig.6?

Authors: any lat/lon dependence were found in case of differences between Repro1 and Repro2

- Referee#1 Figure 10 – Check the caption and the legend (RP1?,RP2?)

Authors: In the caption of the figure was mistake. It has been changed to: 'Differences between the values of the 18-year linear trends obtained from the Repro2 and the

Repro1 campaigns, compared to the 18-year ZHD linear trend obtained from VMF1' All the other comments, corrections, and typos have been changed in accordance with Referee suggestions.

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