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Atmospheric Measurement Techniques Discussions

Interactive comment on "Constructing Precipitable Water Vapor Map from Regional GNSS Network Observations without Collocated Meteorological Data" *by* Biyan Chen et al.

Anonymous Referee #3

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General Comments.

The manuscript describes a method to convert GNSS-derived Zenith Total Delay into Precipitable Water Vapour using, for each GNSS stations, surface pressure and weighted mean temperature of the atmosphere obtained interpolating nearby synoptic observations. The analysis is well presented and the results sound reasonable. However, I would raise the following issues which has to be clarified prior to the publication.

1. In the paper, there is no indication on how GNSS data are analyzed: which strategy is applied for estimating ZTD? Which global products are used? What is the ZTD sampling rate? What is the accuracy of the GNSS ZTD estimates? What is the latency

of GNSS ZTD estimates?

2. The authors claim they are presenting a method inferring 'accurate' Ps and Tm and for the construction of 'high-quality' PWV maps. Both 'accurate' and 'high-quality' has to be quantified with respect to the target application the authors are interested in. This because the observational requirements are different according to the different target application. I would suggest reviewing the title by adding in it the target application of this research.

Below specific comments.

Line 13 pag.1. My suggestion is to replace '(GNSS) data' with '(GNSS) Zenith Total Delay (ZTD) estimates'

Line 25 pag.1 replace 'ERA reanalysis' with 'ERA-Interim reanalysis'

Line 4 pag.2 Suggested reference: Guerova, G., Jones, J., Douša, J., Dick, G., de Haan, S., Pottiaux, E., Bock, O., Pacione, R., Elgered, G., Vedel, H., and Bender, M.: Review of the state of the art and future prospects of the ground647 based GNSS meteorology in Europe, Atmos. Meas. Tech., 9, 5385-5406, doi:10.5194/amt-9-5385-2016, 2016.

Line 7 pag.2 'for a better performance', please clarify this statement.

Line 8 pag.2 See general comment. The accuracy of the GNSS ZTD estimates depend on how the data are processed and on the global products used in the processing. For example, the agreement of reprocessed ZTD estimates is at 2 mm level (reference Pacione, R., Araszkiewicz, A., Brockmann, E., and Dousa, J.: EPN Repro2: A reference GNSS tropospheric dataset over Europe, Atmos. Meas. Tech., 10, 1689–1705, doi: 10.5194/amt-2016-369, 2017).

Line 24 pag.3 what is the average distance between a synoptic station and a GNSS station?

Line 26 pag.3 I guess the ZTD sampling rate is higher than 6h, right? If so, how do you interpolate in time pressure and temperature data measured at the synoptic station? What is the error of this interpolation? Such error has to be added in the error analysis done in section 4.1.

Line 28 pag.3 What kind of radiosonde are used?

Line 12 pag.5 Different set of refractivity coefficients are available in literature, please add the reference about the used ones.

Line 18 pag.5 The empirical model of eq.4 suffers from diurnal and seasonal biases, are such biases acceptable for the considered application?

Line 22 pag. 5 Could the authors explain on which ground they chose 100 km as the radius of the circumference centred on the GNSS site? On average, how many synoptic stations fall into that area for each GNSS sites?

Line 7 pag.6. Considering eq.7, what is the interpolation error?

Line 10 pag. 7 Why in this error analysis the authors are not considering the ZTD error? The ZTD error is of course the same in both models the authors are evaluating but I think has to be considered in the total error bubget.

Line 1 pag. 10 Replace 'measured' with 'estimated'

In the manuscript several times, ECMWF should be replaced with ERA-Interim. The quality of the maps should be improved. Fig. 8a check the white spot

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