

Review of Peng et al. 2018
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Recommendation: Major Revisions

General Comments

Firstly, this paper is in terrible need of proofreading by a native English speaker. The paper is very poorly written and is nearly incomprehensible in some parts. Correcting grammar errors is not the responsibility of the reviewer; this paper should have been checked beforehand. After line 170, I have stopped correcting these grammar errors and I just focus on content.

The subject of the the Bevis and other models has been examined many, many times, globally and regionally. See the work of June Wang (SUNY) and for example Luiz Sapucci (Brazil). There has to be a very strong motivation to continue this type of work. Improvements of 1 or 2mm in PWV are not very impressive and hardly seem worthwhile considering all of the other inherent errors in the GPS PWV method itself, errors in radiosondes, errors in ERA Interim data and other reanalysis products (which may not be independent of radiosonde in the first place).

The authors need to better justify why these tiny improvements given the work required are really advantageous. More importantly, errors due to surface pressure are much larger. The height of the antenna relative to the surface pressure measurement will introduce a much larger error than what you present here with T_m models. You should do an analysis of these errors. How large are the errors associated with a reasonable error or 5mb in surface pressure? Likewise, the assumption of ZHD representing the mass of the atmosphere (excluding water vapor) is erroneous. What are the errors associated with this assumption? Compare the Amazon to a desert region to assess this error somehow.

Add these analyses to the study and it would be improved.

Specific Comments.

Check your spacing on the in-text citations.

Abstract

Line 10 Write “In near real-time GPS-PWV retrievals,”

Line 13 Write “ without data smoothing”

Line 14 “Then static and time-varying global gridded T_s –T_m”
I am not sure what you mean here by “Then”

Line 16 Write “have prominent advantages over other”

Line 17 Write “Large biases in Bevis’ equation or in latitude-related linear models at a considerable number of stations”

Line 18 Write “Multiple statistical tests at the 5% significance level”

Line 29-30. This sentence is awkward, rewrite.

Line 31 Write “such as radiosondes and water vapor radiometers,”

Line 36. Slant water vapor(SWV) are not “widely used”

Line 37-38 I don't know what you are trying to say here.

Line 44 Write “The mapping function...”

Line 49. P_s also has a significant effect on PWV calculated from GPS signal delays, because it represents the mass of the dry atmosphere.

Line 54 Write “ The integration of”

Line 58-60 Rewrite this sentence, it is difficult to follow.

Line 66 Write “ can be lost without the constraint of real data.”

Line 68 Write “numerical weather prediction.”

Line 80. “there exist large differences between the oceanic and terrestrial atmospheric properties.” This depends. At the surface layer and boundary layer, yes, but about the boundary layer it is less clear. You should specify what you mean here.

Line 81 Write “oceanic regions” not sea regions

Line 85 “however is statistic and the estimated T_m residuals due to time variations are not fixed (Yao et al., 2014a).”

I don't understand what you are trying to say here.

Line 87 Write “spatial smoothing of the data”

Line 101 What do you mean specifically “atmospheric top” (i.e. top of the atmosphere). Give a value.

Line 105 Write “We employed radiosonde data from the Integrated”

Line 106. You should show PWV sensitivity to surface pressure. Using Bevis' model, the sensitivity is about 3 times greater to surface pressure than to T_s .

Line 107 Write “may be”

Line 109 Surface **observations** must be available, and top profile level should not be lower than 300 hPa standard level.

Oftentimes, the first level of a radiosonde has erroneous data, over influenced by surface conditions. You should quality check the first level of the sounding for bad temperature and humidity data.

Line 111. Much greater the 5 levels 1000mb to 300mb is necessary. Maybe a more stringent criterion is needed. Maybe 10 levels, you should check the sensitivity of your results to this assumption.

Line 113. “Profile data including same elements are usually provided by NWP products at certain vertical levels.”

It is not clear what you mean by same elements. I assume you mean the same variables. You should also say what the cone of representation of the GPS is, so one can consider that with respect to the “vertical” measurements of the radiosondes.

Line 116. ERA Interim humidity products can be awful, particularly in regions where little observational data exist. ERA-5 somehow is better, not sure, how they managed this.

Line 120 Write “However, water vapor is solely concentrated in the troposphere, and most of it, specifically within the first 3 kilometers above sea-level.”

Line 125 “to the height replacement will extremely approximate to zero.”
This doesn’t make sense, rewrite.

Line 137 Write “We first carried out a linear regression analysis”

Line 140 Correct this sentence.

Line 145 Write “It is evident that T_m varies”

Line 148 This sentence makes no sense.

Line 169 Write “Since the $T_s - T_m$ relationship has”

Line 236. Remember that the radiosondes are incorporated/assimilated into reanalysis products, so the data are not independent. So you may not be correctly capturing real errors and biases in the data.

Line 314. Remember, there is an inherent error in the assumption of the calculation of ZHD, which assumes that the water vapor is not contributed to the mass of the atmosphere. This error may not be important but should be evaluated for very wet regions (e.g, the Amazon) and very dry regions.

Line “Because the T_m from ERA-Interim is believed to be the most accurate”

This is a very strong statement. You need to provide evidence considering the purpose of this paper is entirely dependent on the quality of the observations. As I said before these data are not necessarily independent of the radiosondes and their humidity data in regions with few observations can be awful.

The errors that you present as a function of T_m as tiny. I am perfectly happy to work with data with only of few percentage error. Maybe a 10% change is worth noting, but I am not too stressed about errors of these sizes, particularly considering all the assumption going in to the calculations of PWV from GPS ZTD.

Reference

Sapucci, L.F., 2014: [Evaluation of Modeling Water-Vapor-Weighted Mean Tropospheric Temperature for GNSS-Integrated Water Vapor Estimates in Brazil](https://doi.org/10.1175/JAMC-D-13-048.1). *J. Appl. Meteor. Climatol.*, **53**, 715-730, <https://doi.org/10.1175/JAMC-D-13-048.1>