

Interactive comment on “Global IWV trends and variability in atmospheric reanalyses and GPS observations” by Ana C. Parracho et al.

Anonymous Referee #2

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The manuscript includes a lot of information. It (1) compares PW monthly and seasonal means, interannual variability, and linear trends between reanalyses and GPS data for 1995-2010, (2) studies PW trends for 1980-2016 using two RA products, (3) looks at the relationship between PW and surface temperature trends, and then (4) tries to link the dynamics with PW trends and variability. The authors have done a lot of work, but it is hard to figure out what the focus of this study is and what original results are achieved. In the major comments below, I raised several major concerns. Based on that, I think that the manuscript needs major revision or is resubmitted later. Major comments: 1. Scientific originality: The scientific originality first starts from the review of prior studies and the motivation of this study. As I mentioned below, some important references are missing in the introduction. Then the authors have to provide rationale

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on why they want to study those four things (listed above). Have they never done before? Are your data better than that previous studies used? Are you going into more depth on those topics? I didn't see the strong motivation explained in the introduction. All those topics have been studied extensively before. What new and significant results does this study provide? The authors touched so many things, but didn't emphasize their originality. The authors try to describe all things they have done in a tedious way, so the manuscript looks more like a work summary, rather than synthesized scientific paper. I think that previous studies have done a lot for #1, #2, #3. Maybe the focus should be on briefly summarizing your results to establish the bases on using reanalysis data, and then on linking the dynamics with PW variability. For the first three, your results should be compared with previous studies, and then emphasize new results you found. 2. Technical quality: Again too much information is provided including too many topics, tedious descriptions of all results and too many plots. After you decide the focus, the manuscript should be reorganized and be shortened. 3. References: The manuscript didn't include some of relevant references. I mentioned this in several places in Specific comments. You can find a lot of references from the review paper by Guerrova et al (2016, Review of the state of the art and future prospects of the ground-based GNSS meteorology in Europe, AMT).

Specific comments: 1. GPS vs. GNSS: I would suggest that GNSS is used instead of GPS. 2. P1, L13: Do gaps affect monthly mean if they last longer? 3. P1, L24: What temperature? Surface or upper air? 4. Abstract: I didn't learn a lot anything new from this. 5. P2, L5-8: Lots of papers have discussed this. Please list some references. 6. P3, L10, Fig. 1: This map only shows 104 stations, much less than thousands of available stations. It is not convincing about "growing". I understand that those are the stations used in this study. But it is not convincing to use this to make your point here. 7. P3, L28: There have been quite a few studies using GNSS PW to evaluate reanalysis products. First of all, you should summarize the prior studies on this, and then describe what is different (unique) about this study. 8. P5, L1: Should you just simply average the surrounding grid points or have more complicated regression? It

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depends on the location and topography. See Fig. 1 in Mears, C., J. Wang, D. Smith, and F. J. Wentz, 2015: Intercomparison of total precipitable water measurements made by satelliteborne microwave radiometers and ground-based GPS instruments. *J. Geophys. Res. Atmos.*, 120, 2492–2504, doi:10.1002/2014JD022694. 9. P7, L10, the standard deviation is calculated from seasonal mean values. Is it right? In other words, only 16 data points are used to calculate standard deviation? Is the standard deviation statistically significant given only 16 data points? 10. Fig. 5: The trends are calculated using monthly PW anomaly, not monthly mean, correct? Fig. 5 is a similar plot as Fig. 4 in Wang et al. (2016). You need to discuss how your results compare with Wang et al. (2016) here. 11. P10, L33-34: For WUHN, the big change in Oct 2016 is due to the radiosonde type change from Shang-M to Shang-E. Radiosonde data over land are the main source of upper air humidity for reanalyses, so any inhomogeneity in radiosonde data would be reflected in the reanalysis data.

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