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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Comparison of Global Observations and Trends of Total Precipitable Water Derived from Microwave Radiometers and COSMIC Radio Occultation from 2006 to 2013" *by* Shu-peng Ho et al.

Anonymous Referee #2

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This study compares passive microwave (MW) estimates of total precipitable water (TPW) with radio occultation (RO) profiles of TPW that are closely matched together in space and time. The comparison is broken into four parts: clear sky, cloudy sky, cloudy sky with no precipitation, and cloudy sky with precipitation. The bias is smallest in clear sky and is largest within precipitating conditions. The bias is shown to be a small function of surface temperature, surface wind speed, etc., but these effects have little consequence on the interpretation of biases and trends, which lends further confidence to the results of this work. The trends in TPW are statistically significant

and are larger than previously reported. The trends are uniformly largest within cloudy non-precipitating skies, and can be slightly negative in clear sky for a few of the MW radiometers.

This is a very straightforward and useful study that is well written and flows logically. I only have a few minor comments and suggestions before this paper is accepted for publication.

Abstract and elsewhere: non-precipitating and precipitating conditions instead of non-precipitation and precipitation conditions? I'm not an expert in grammar but the latter reads a little odd.

Lines 52-54: is the global water vapor feedback still one of the largest uncertainties? We seem to know that the water vapor+lapse rate feedback has less spread in climate models than cloud feedbacks (see Soden et al., 2008, J. Climate, Figure 7, and other references). The role of water vapor and its regional variability, such as shown in Figure 10 in the manuscript, is probably the more uncertain quantity rather than global trends as shown in Figure 9. To summarize, it might be better to emphasize the role of water vapor in controlling cloud processes, and observing long term trends in water vapor is part of that understanding.

Line 66: land and ocean

Line 68: ocean

Line 195: IWC can be even a bit higher than that in convective towers, see D. Leroy et al., 2017, J. Atmos. Ocean Tech. that summarizes the HAIC/HIWC field campaign

Lines 233-234: what is the percent frequency of COSMIC water vapor profiles that sample below 0.1 km?

Lines 246-249: the larger spatial variance of water vapor in the tropics compared to the extratropics should be reflected in the higher standard deviations, and their increases sensitivity to collocation distance. Have the authors explored these differences? Would also be helpful to cite a paper or two on the spatial variance of water vapor.

Line 250: a little bit of extra clarification on the matchups is warranted. Does one really get 20-60 MW pixels near a RO observation within a 1-hour period? This seems excessive. Is this at 0.25 degrees resolution or a larger distance? Are the matchups for the entire length of the 200 km RO or with respect to the tangent point at a particular reference altitude?

Line 268: Figures 3a-c (only three panels)

Line 298: under different

Line 310: a small but significant degree seems a little bit contradictory, maybe there is a better way to state this

Line 314: droplets

Line 385: Australian, and also South America

Line 412: reliable references

Lines 432-440: can the authors say anything about the magnitudes of these trends and whether they are consistent with the constant RH hypothesis of Earth's atmosphere?

Line 494: author list for reference is incomplete

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