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Atmospheric Measurement Techniques Discussions

Interactive comment on "Intercomparison of in situ water vapor balloon-borne measurements from Pico-SDLA H₂O and FLASH-B in the tropical UTLS" *by* M. Ghysels et al.

Anonymous Referee #1

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Review of:

Intercomparison of in situ water vapor balloon-borne measurements from Pico-SDLA H2O and FLASH-B in the tropical UTLS by M. Ghysels et al.

1 General comment:

This manuscript describes the intercomparison of the two balloon borne water vapor instruments PICO-SDLA and FLASH-B. The agreement between both instruments found

in the analysis is exceptionally good even in the low water vapor range of the TTL. The analysis is done in a balanced way and mostly all aspects important for such type of intercomparison are considered. This type of instruments and measurements bring a valuable contribution to the scientific community. The presentation of the manuscript is mostly good and overall nicely to read. It is well organized and the analysis and results are clearly structured and communicated. For these reasons, I recommend publication in AMT. The authors may want to consider the following comments/questions in preparing the final/revised version.

2 Specific comments/questions:

p. 12695 ll. 14-15: I think this statement is too strong. This level of agreement for measuring stratospheric water vapor is also found by others and reported already in the literature. For example in Rollins et al. (2014) you can find even better agreements for stratospheric water vapor for different instruments (e.g. DLH<->HWV, CIMS<->DLH or FISH<->FP(balloon)). I guess you mean more the agreement of solely balloon borne intercomparisons. I recommend to rephrase this sentence in a similar way you have done it in your conclusions (p 13714 ll. 5-8) or in section 5 (p. 13713 ll. 3-6).

p. 13695 l. 22: I suggest to cite a further study here. Riese et al. (2012) address the radiative impact of small water vapor and other radiative active trace species changes in the UT/LS region. This study would fit well into your introduction and motivates reliable measurement of water vapor in the TTL. Especially, the water vapor filaments of enhanced water vapor above the the CPT found in your profiles.

p. 13699 ll. 12-14: This sentence is somewhat unclear and should be rephrased with more explanation which transition is actually meant by the authors. It could be the selection of the different absorption transition or the transition region where the retrieval is changed from one line to the other...

p. 13701 ll. 12-14: Here you describe the uncertainty range of PICO measurement in the TTL. Are here all error sources included, i.e. measurement errors and also errors due to retrieval assumptions like uncertainties in the HITRAN database ?

p. 13701 ll. 20 f.: For the comparison of temperature measurement of both sondes the lunch time (day or night) is quite important to know. Maybe i missed it somewhere, but if not could you please include the time of both sounding into the text.

p. 13708 ll. 18-21: You determined the CPT from each temperature profile separately and found a deviation of 350 meters and for the other sounding a deviation of 500 meters. Maybe this is hard to answer, but what is your suggestions for these differences ? Can this be attributed only to the local and temporal change in the temperature profile or also to instruments uncertainties in the temperature and altitude determination like shifts and offsets etc. ?

p. 13710 ll. 19-24: The altitude determination for both sonde types is different. For the 13 March profile you describe the correction of altitude to harmonize both profiles. Did you apply these correction also for the flight on 10-11 February ? If so, i recommend to move this paragraph to either section 2.2 or 4.1 to avoid confusion which correction is performed on which sounding.

p. 13712 Sec. 5: The comparison and correlation of both instruments is in principal correct and convincing, but especially the local variability of water vapor (filament structure) makes is difficult to compare solely the instrument performance. Therefore i suggest to add an additional correlation analysis for all data from CPT to maximum hight without the water vapor filaments. This would reduce the scatter in Figure 7 and enable you to get an even better correlation coeff. and agreement of the TTL background water vapor measurements.

3 Technical comments/suggestions:

p. 13696 l. 1: Maybe include "Regular" before "Radiosonde measurements..."

p. 13697 l. 6: I suggest to remove "the" before "deep-convection" and change "overshoot" to plural.

p. 13698 l. 13: "Measurements" should be singular.

p. 13708 ll. 25-26: I suggest to remove "especially for water vapor." It is doubled in the sentence...

p. 13711 ll. 14-15: This sentence needs some revision... "the local maximum...stands out with a local maximum..."

p. 13712 ll. 22-23: This is not a full sentence and the verb is missing.

Figure 2: I suggest using three different colors for the measured spectra would make them better distinguishable, especially in the bottom panel where you show the residuals.

4 References:

Riese, M.; Ploeger, F.; Rap, A.; Vogel, B.; Konopka, P.; Dameris, M. Forster, P. Impact of uncertainties in atmospheric mixing on simulated UTLS composition and related radiative effects Journal of Geophysical Research-atmospheres, 2012, 117, D16305

Rollins, A. W.; Thornberry, T. D.; Gao, R. S.; Smith, J. B.; Sayres, D. S.; Sargent, M. R.; Schiller, C.; Kraemer, M.; Spelten, N.; Hurst, D. F.; Jordan, A. F.; Hall, E. G.; Voemel, H.; Diskin, G. S.; Podolske, J. R.; Christensen, L. E.; Rosenlof, K. H.; Jensen, E. J. Fahey, D. W. Evaluation of UT/LS hygrometer accuracy by intercomparison during the NASA MACPEX mission Journal of Geophysical Research-atmospheres, 2014, 119,

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