

## ***Interactive comment on “Intercomparison of mid-latitude tropospheric and lower stratospheric water vapor measurements and comparison to ECMWF humidity data” by Stefan Kaufmann et al.***

### **Anonymous Referee #3**

Received and published: 28 August 2018

The manuscript describes an intercomparison of water vapor instruments aboard the DLR HALO aircraft during the 2014 ML-CIRRUS airborne campaign. The manuscript is generally very well written. I recommend that some relatively minor changes be made prior to publication. Recommended changes follow, in order of more important to less important.

Section 4.2: This section discusses the filtering of campaign data from the five water vapor sensors for the purpose of enabling the intercomparison. This is an important activity, and the methods by which it is done can have measurable effects on the outcome. The primary utilities of an intercomparison are (1) to create a unified, self-

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consistent dataset which enables greater scientific meaning than would be obtained using only one measurement; and (2), to create a means to understand data obtained when the intercompared sensors are operating without the other(s). This intercomparison generally falls into the second category. For that purpose, most of the data filtering described seems appropriate, but in the final paragraph, a process is described which throws away data for which there are explainable or unexplainable problems. These data, if they appear in the official project data archive, should not be removed because they disagree with the other measurements. It is in these disagreements that one can learn about the ultimate reliability of a measurement, and removing these data hides that information. If these data are actually not in the data archive because the suppliers of the data had already marked it as unreliable, then this fact should be stated.

Section 5: The final two sentences of this section (page 9, lines 20-24) describe additional removal of data due to the disagreement shown. This is similar to the issue described above. Again, if the data are in the archive, the comparison should include those data. If they are not, the authors should note that.

Section 3.1: The AIMS instrument is described. On page 5, line 2, the text indicates that the instrument “was calibrated once or twice during each research flight.” How consistent were the in-flight calibrations, both in a single flight, and among all the flights? At what conditions were they performed? Is there any trend to the differences in calibrations?

Section 3.4: The HAI instrument is described, including the fact that it uses two different wavelengths. But on page 6 line 9, the statement is made that only the 1.37 um data are used in this intercomparison. Why is that?

Section 3.x: These sections describe each of the instruments, and provide some information on accuracy and calibration. Unfortunately, the same information isn't provided for all of the instruments. The authors should amend each of the sections to include all of the same important information, including accuracy, precision, time response, and

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method/timing of calibrations. Some, but not all, of this information is in Table 1.

Section 1: This section provides background on airborne water vapor measurements and intercomparisons done with those measurements, including ground-based intercomparisons. The authors might also include intercomparisons reported by Jensen of measurements made during the NASA ATTREX campaigns on the Global Hawk aircraft in the UT/LS/TTL. Comparisons during ATTREX were generally better than those from AquaVIT-1 and MACPEX.

Section 4.3: This section describes the selection of the reference value, and mentions the fact that no single instrument covers the entire range of values observed. This seems to imply that it would be common for some combination or combinations of instruments to be used on this and other German aircraft during other campaigns. Is that the case? If so, which instruments typically fly together? And how do they generally compare in the ranges where they have overlapping measurements?

Section 6: On page 15, line 20, drift is discussed, but the statement is made that observed relative changes between measurements made by the AIMS and SHARC instruments are not due to drifts in either instrument. As this seems to be difficult to reconcile with the observations, what do the authors suggest is the cause or explanation?

Minor word changes, etc.: Page 1 Line 16 – suggest replacing “turned out to be” with “is” Line 24 – suggest replacing “total mean values even agree” with “and total mean values agree” Line 31 – suggest replacing “deficit” with “error”

Page 2 Line 9 – suggest removing “their” Line 32 – suggest adding “but as-yet undocumented” before “campaigns” Line 33 – suggest adding “during AquaVIT-1” before “was improved” and replacing “compared” with “relative”

Page 3 Line 15 – suggest replacing “major” with “primary” here and elsewhere.

Page 7 Line 25 – “less” should be replaced by “fewer”

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Page 10 Line 5 – suggest replacing “way” with “well”

Page 11 Line 16 – typographical error: “ofmeteorological” should be “of meteorological”

Page 13 Line 14 – should “interpolated” be “averaged” ?

Page 14 Line 23 – add comma after “hygrometer”

Page 15 Line 28 – replace “IQR” with “interquartile range”

Page 16 Line 12 – replace “access” with “assess”

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-744>, 2018.

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