Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-397

Anonymous Referee #1

Referee comment on "Determination of atmospheric column condensate using active and passive remote sensing technology" by Huige Di et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-397-RC1, 2022

General Comments:

This study presents an observation method for detecting atmospheric column condensates by combining millimeter-wave radar (MWR), lidar and microwave radiometers. This work is interesting and meaningful. Especially, the authors stated that it is the first application to operate observations of atmospheric column condensates. However, there are some issues in this manuscript, as listed below, that need to be carefully considered. Moreover, the English should be improved substantially, especially for Abstract and Results and discussions. I think this manuscript can be considered for publication only if the author could adequately address the comments below.

Specific comments:

- Lines 16-18. The author specifically mentions stratiform clouds. Is their atmospheric columnar condensate calculated differently? Moreover, the atmospheric column condensate in stratiform clouds is calculated by the saturated water vapor density and vertical airflow velocity, but the saturated water vapor density is not mentioned in the later observed quantities in the abstract.
- The authors keep emphasizing that it is "atmospheric column condensate", but the actual object of observation is cloud, so would it be more appropriate to change it to "cloud column condensate"?
- Figure 1. The authors should provide appropriate explanations for the schematic diagram. g., it is not clear whether the horizontal arrows of "Input or output airflow" represent total input or output, or just the horizontally oriented input or output.
- Lines 116-117. To my knowledge, the unit of saturated water vapor density is g/m^3. Please check it.
- Lines 123-125. Please define R_v and give a reference to the equation's source.

Furthermore, e is the water vapor pressure, and its unit should be similar to hPa, not kg/m^3. Please check it.

- Figure 2. P_{cong} means the net flux from t1 to t2, so the label "Columnar condensation water" in the figure seems inappropriate.
- Lines 182-183. Does the overline mean sum or average? What's more, the formula is valid on the assumption that the detection errors of S and V do not vary with time and are independent of each other. This should be declared in advance.
- Figure 6. It seems difficult for the reader to understand in detail how the vertical velocity is obtained from the schematic. Additional instructions need to be provided.
- Lines 255-260. Reflections from raindrops can interfere with the signal, so how much uncertainty is there in wind speed measurements in rainy conditions?
- Lines 287-289. A result picture of the cloud phase state should be shown.
- Lines 295-297. The results of the microwave radiometer should be displayed and validated in Sect. 6. Moreover, how was the final temperature determined in figure 10? Is it a combination of rotational Raman lidar and microwave radiometer measurements?
- Figure 12. The y-axis label "Condensation water" seems inappropriate, since it is the water vapor flux. And why are there only positive flux values in the figure?
- Lines 326-329. (1) The authors say that "the condensate in the period from 21:00 to 23:00 was integrated" and that "rainfall at 06:00 a.m.", but what about the water vapor input and output from 23:00 to 6:00. It should be clarified. (2) According to the description, the total amount of the maximum possible condensate counted in this manuscript was 88.2 g (2.94 mm). The atmospheric column condensate can be obtained by integrating the instantaneous water vapor flux. It is worth noting that the unit of instantaneous water vapor flux is $g/m^2/s$, and its unit after integration with respect to time (s) should be g/m^2. This indicates in a physical sense how many grams of water vapor is transmitted per square meter (input or output). So I don't understand how the authors got the results in g or even mm.

Minor comments:

- Line 36 and Line 65. The abbreviations need to be defined in the abstract and then again at the first instance in the rest of the text.
- Line 78. The right side seems to be GMh. This is not accurate.
- Line 162. The abbreviation RH is not needed because it is not used later. The same situation in photomultiplier tubes (PMTs), pure rotational Raman (PRR) and so on.
- Line 252. The W_{air} needs to be defined at the first appearance.
- Lines 269-270. The caption should be improved.
- Line 277. The name should not be all caps, also in Line 304.
- Figure 10. In the title of the picture, "… cloud topon …" should be "… cloud top on …". And drawing a 0-value line in the picture can better help the reader capture the information.