Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2022-282

Anonymous Referee #2

Referee comment on "Long-term detection, mapping, and interpretation of the trend of ozone in China (1978–2020) by constructing long-term consistent ozone datasets" by Rongqi Tang et al., Atmos. Meas. Tech. Discuss.,
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General Comments: The paper written by Tang et al. attempted to analyze the vertical structure of ozone using various satellite data. It may be meaningful in that it analyzed various satellite data and in situ ground measurement data for long-term period. However, it seems that a lot of revision and improvement is needed in the organization of outline, interpretation, and method in this paper. In particular, the results were also not sufficiently explained even though there was a difference from previous studies. In my opinion, it will take a lot of time to improve and modify, so it will be difficult to recommend a publication in its current status.

Major comments:

1) L22-24: Inconsistent with the statement in the results section. In the result section, the interannual variation was not evident in the lower troposphere.

2) L26-28: This sentence is very vague and difficult to understand. What are the opposite characteristics?

3) Introduction Section: Overall, it seems necessary to mention more recent research on trends in tropospheric ozone over East Asia. Recently, many studies on the ozone trend in East Asia have been published, but are not mentioned in this study. I recommend following studies.

-Zhang et al., (2021) Long-term ozone variability in the vertical structure and integrated column over the North China Plain: results based on ozone sonde and Dobson

measurements during 2001–2019

-Shin et al. (2021) Total Ozone Trends in East Asia from Long-Term Satellite and Ground Observations

-Zhu et al. (2022) Satellite-Based Long-Term Spatiotemporal Patterns of Surface Ozone Concentrations in China: 2005–2019

-Wang et al. (2019) Twentyâ□□Five Years of Lower Tropospheric Ozone Observations in Tropical East Asia: The Influence of Emissions and Weather Patterns

4) L101-104: Does this mean that ozone exchange at different altitudes within the troposphere will also be identified?

5) Section 2.1: If the main description of Section 2.1 is to classify China into six sub-regions (Northest, North, East, Northwest, Southwest, and Central South..), why not present an explanation of the classification of sub-areas fist and then explain the reasons for this classification by climate and regional emission characteristics?

6) L115-122: References related to the monsoon climate in China should be presented.

7) L132-133: Reference Required

8) L159-168, L169-174: Descriptions of each satellite, sensor, and output data require references.

9) L194: Is the spatial resolution of the AIRS data analyzed in this study 13.5 km?

The horizontal resolution of satellite data seems to be important for trend analysis, but the horizontal resolution of satellite data used in this study is not clearly described. If grided satellite data (level 2 or level 3) is used, the horizontal resolution should be presented.

10) L191-200: References related to AIRS data must be added.

11) L238-240: Did you perform statistical analysis other than R and RMSE? Other statistical analysis results were not seen in the result section. If you used only two indexes, you should change “several indexes” to “two indexes”. However, further statistical analysis is recommended.

12) L252-L254: What is the basis for excluding data points with absolute differences lager than 20μg/m^3 from the comparative analysis?

This is a very strange analysis method for me. It's like tuning to make the results look good.

13) L276-281: Reference to CDF?

14) L311: What are the references to the "simple empirical formula" and equation (5)? Is this "simple empirical formula" a method applied in some previous studies?

15) Figure 3: Figure 3 shows the comparison analysis for whole Chinese areas? The range of study region should be presented. In addition, the sample sizes (number of data) in Figure 3 are 146~163. But, if daily data is used in this analysis, it should be much more data samples because the number of sites is greater than about…200 (as shown in Figure 1).

16) L345-347: "in situ measurement" means herein a "sonde measurement"? If so, it should be stated that the “in situ measurement” in this sentence means sonde observation data for the purpose of distinguishing it from the ground measurement data described in the above paragraph.

17) Section 4.1.2: If Section 4.1.2 only presents R and RMSE values, the average value of each data must be presented for the interpretation of RMSE values.

18) L449-490: Detailed description of this method is required. This calculation seems to be important to the results, but it is presented too briefly. Also, what area is for “spatial mean” here?

19) Figure 7: Figure 7 should be modified. Additional graphs showing zoom-in for 1) the lower troposphere (3-6 km) and 2) peak altitude (26-31 km) should be added for meaningful analysis. In the current graph, the difference between the highest and lowest values is so huge that it seems to be no interannual changes of O_3 in the upper and lower

layers, so it seems meaningless.

20) Figure 8 and Section 4.3.1: Interannual variation was analyzed through Figure 8 in "4.3.1. Monthly variation" section. In the box-and-whisker plot in Figure 8, it is necessary to describe what each box and whisker mean. In particular, it is necessary to explain whether the box range means interannual variation. In addition, in order to accurately analyze whether there is a large increase or decrease in the annual O3 variation, it is necessary to analyze the interannual variation for the six regions like Figure 9.

21) L572-L577: Need to mention in more detail why the two groups differ.

22) L582-584: Need a detailed explanation of what "atmospheric circulation" means.

23) L599-601: Why does O_3 trends at only 34 km not increase with latitude?

24) In Figure 10-(f), the reason why the slope decreases evenly according to the latitude is there any issue due to satellite sensor aging? Why does Slope show this pattern?

25) L615: Reference is required to refer to "general variation laws"

Minor comments:

1) Define AIRS, AERONET, GOSAT, TOMS, OMI, etc. without using abbreviations when words first appear.

2) All "hp" in the paper should be replaced with "hPa".

3) The ug/m^3 that appears occasionally in the paper should be corrected to μg/m^3.

4) L387: put a period at the end of sentence.

5) L457: TROOMI --> TROPOMI

6) L490: from 1978 --> from 1978 to 2020?

7) Figure 12: “Spetember” --> “September”

8) L661-662: Provide the approximate range of latitude and longitude for QTP and North China Plain.