Comments by Owen R. Cooper (TOAR Scientific Coordinator of the Community Special Issue) on:

Investigation of satellite vertical sensitivity on long-term retrieved lower tropospheric ozone trends

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This review is by Owen Cooper, TOAR Scientific Coordinator of the TOAR-II Community Special Issue. I, or a member of the TOAR-II Steering Committee, will post comments on all papers submitted to the TOAR-II Community Special Issue, which is an inter-journal special issue accommodating submissions to six Copernicus journals: ACP (lead journal), AMT, GMD, ESSD, ASCMO and BG. The primary purpose of these reviews is to identify any discrepancies across the TOAR-II submissions, and to allow the author teams time to address the discrepancies. Additional comments may be included with the reviews. While O. Cooper and members of the TOAR Steering Committee may post open comments on papers submitted to the TOAR-II Community Special Issue, they are not involved with the decision to accept or reject a paper for publication, which is entirely handled by the journal's editorial team.

General Comments:

TOAR-II has produced two guidance documents to help authors develop their manuscripts so that results can be consistently compared across the wide range of studies that will be written for the TOAR-II Community Special Issue. Both guidance documents can be found on the TOAR-II webpage: https://igacproject.org/activities/TOAR/TOAR-II

The TOAR-II Community Special Issue Guidelines: In the spirit of collaboration and to allow TOAR-II findings to be directly comparable across publications, the TOAR-II Steering Committee has issued this set of guidelines regarding style, units, plotting scales, regional and tropospheric column comparisons, tropopause definitions and best statistical practices.

The TOAR-II Recommendations for Statistical Analyses: The aim of this guidance note is to provide recommendations on best statistical practices and to ensure consistent communication of statistical analysis and associated uncertainty across TOAR publications. The scope includes approaches for reporting trends, a discussion of strengths and weaknesses of commonly used techniques, and calibrated language for the communication of uncertainty. Table 3 of the TOAR-II statistical guidelines provides calibrated language for describing trends and uncertainty, similar to the approach of IPCC, which allows trends to be discussed without having to use the problematic expression, "statistically significant".

Major Comments:

This analysis aims to investigate long-term ozone trends but it only focuses on 2008-2017, which is just 10 years. Given the high interannual variability of ozone, the authors seem to conclude that 10 years is too short to investigate long-term trends. Based on previous work, this finding is to be expected. The following papers discuss the challenges of detecting ozone trends on short time scales, given the high degree of interannual variability, and limited sampling rates: Barnes et al., 2016; Fiore et al., 2022;

Chang et al., 2020; Chang et al., 2024 (submitted to the TOAR-II Community Special Issue). It would be helpful if this topic can be discussed in the Introduction to set the stage for the analysis.

Figures 1, 2 and 3 compare satellite products to ozonesondes across fairly large regions. It's not clear how this comparison is done. It seems that the model is compared to co-located sondes, but what about the satellite products? Are the satellite products in these figures also compared to co-located sondes, or are the satellite products averaged over the full continental domains? The N. America, Europe and East Asia regions are very large (based on the HTAP map), but how many ozonesonde sites are available across these regions for comparison? A map showing the locations of the ozonesonde stations would be very helpful. I am aware that the western part of the N. America domain that stretches all the way to western Alaska has no in situ ozone observations west of Edmonton. Why include this far-flung region when it can't be compared to observations? Likewise, I don't know of any ozonesondes launched west of Beijing, yet the East Asia domain stretches all the way to Kyrgyzstan. The supplement describes the comparison of satellite products and ozonesondes for the purposes of deriving the BCFs. Sondes and satellite data are matched if they fall within 500 km of each other. Why is such a large distance permitted? This is probably fine if you are dealing with monthly means, but if you are matching sondes and satellite products for specific times (e.g. within 6 hours), this could introduce a lot of error. Previous work has shown that free tropospheric ozone can be highly variable on relatively small spatial scales of roughly 100 km, especially in the vicinity of fronts (Bethan et al., 1996; Cooper et a., 1998).

Figure S3 is not very informative as it gives no information regarding the correlation of the data. Gaudel et al. 2024 (submitted to the TOAR-II Community Special Issue) provide some very clear comparisons between observations (ozonesondes and IAGOS profiles) and a range of satellite products, based on co-located monthly means. These scatter plots show the bias and correlation and also show how the satellite products perform for the extreme values. It would be helpful if Figure S3 can be plotted in a similar way.

Minor Comments:

line 58
presents should be presence

line 64
Beginning a sentence with "However" suggests that this sentence contradicts the previous sentence, but it does not. This sentence merely reports the findings of Gaudel et al. 2018.

line 75
This sentence claims that the cause of the positive OMI trends and the negative IASI trends was caused by the sensitivity to different layers of the troposphere. But no study has ever shown this, and this was not a definitive conclusion of Gaudel et al. 2018.

In the conclusions, when mentioning future satellite programs, you can also list the NOAA GEO-XO and NEON satellite programs:
https://www.nesdis.noaa.gov/our-satellites/future-programs/geostationary-extended-observations-geoxo
https://www.nesdis.noaa.gov/our-satellites/future-programs/near-earth-orbit-network-neon

Figure S2
This plot is difficult to read because the colorbar is smooth rather than discrete. Please use discrete colors, and assign an HTAP regional number to each color.

References

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