December 9, 2024

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

Influence of nitrogen oxides and volatile organic 1 compounds emission changes on tropospheric ozone variability, trends and radiative effect

Suvarna Fadnavis, Yasin Elshorbany, Jerald Ziemke, Brice Barret, Alexandru Rap, PR Satheesh Chandran, Richard J. Pope, Vijay Sagar, Domenico Taraborrelli, Eric Le Flochmoen, Juan Cuesta, Catherine Wespes, Folkert Boersma, Isolde Glissenaar, Isabelle De Smedt, Michel Van Roozendael, Hervé Petetin, Isidora Anglou

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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.

Comments regarding TOAR-II guidelines:

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, and tropopause definitions.

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".

General comments:

In the list of authors, please check the spelling and affiliation of co-author Eric Le Flochmoen

Line 46
"America" is a vague term. Please specify if you are talking about North America, Central America, or South America, or a sub-region.

Line 80
"Global Observing System" should be, "In-service Aircraft for a Global Observing System"

Line 83
Given that the IAGOS record only extends back in time to 1994, Fiore et al. 2022 could only base their assessment of long-term trends (1950-2014) on the model simulations, and a few limited surface ozone records.

Lines 87-90
With only 5 years of OMI/MLS data available, Cooper et al. (2014) did not assess trends over such a short time period. But they did assess the average tropospheric ozone burden by latitude.

Line 97-111
Global ozone trends were sufficiently summarized at the beginning of the Introduction, based on the findings of IPCC AR6. This particular paragraph then repeats some of the IPCC findings by citing some of the same papers summarized by IPCC. It also cites the trends reported by Cooper et al. 2014, which are now out of date. The discussion in this paragraph is also fairly disorganized. As the paper is already quite long, I recommend that this paragraph be deleted.

Lines 132-134
The most up-to-date estimates of ozone ERF are provided by Forster et al. 2021 and Forster et al. 2024, so why report the out-of-date findings by Myhre et al. 2013 and Skeie et al., 2020?

Line 137
It would be more accurate to say that your analysis addressed ozone's radiative effect, rather than radiative forcing.

Lu et al. (2024) just submitted a paper to the TOAR-II Community Special Issue and it should be available for the open comment period very soon. This paper is relevant to your study as it uses models to understand the drivers of increasing ozone across East and Southeast Asia. The reference is listed below.

Another recent submission to the TOAR-II Community Special Issue that is relevant to your analysis of ozone's radiative effect is Collins et al. (2024).

Figure 3
This is a very interesting figure, but it is ignoring ozone changes over the oceans. Why leave out the atmosphere that lies above the oceans, which cover 2/3 of the surface of the Earth? I think most

readers would like to see what happens to ozone downwind of East Asia, for example, and these oceanic regions should be shown, as has been done for Figure 4. I have similar comments regarding Figure 5.

At the time of this writing, one of the anonymous referees has posted a set of comments, which are thorough and constructive. However, I have to disagree with this comment: “The most obvious explanation for the positive ozone trend - climate warming - is not discussed in this study, which is a major shortcoming.” Fadnavis et al. only assessed trends over a short 21-year period (1998-2021), and according to the global temperature rate of increase assessed by IPCC AR6, this corresponds to a relatively small temperature increase of about 0.3 to 0.4 C. As shown by Zanis et al. (2022), an ozone climate penalty doesn’t emerge until global temperatures increase by 2-3 C, and even then its only at the surface in high emissions regions. Given that higher temperatures increase the water vapor content of the atmosphere, which reduces ozone’s lifetime, the main impact of climate change is to reduce ozone in remote regions.

References

Collins, W. J., O'Connor, F. M., Barker, C. R., Byrom, R. E., Eastham, S. D., Hodnebrog, Ø., Jöckel, P., Marais, E. A., Mertens, M., Myhre, G., Nützel, M., Olivié, D., Bieltvedt Skeie, R., Stecher, L., Horowitz, L. W., Naik, V., Faluvegi, G., Im, U., Murray, L. T., Shindell, D., Tsigaridis, K., Abraham, N. L., and Keeble, J.: Climate Forcing due to Future Ozone Changes: An intercomparison of metrics and methods, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-3698, 2024.

Lu, Xiao, et al. (2024), Tropospheric ozone trends and attributions over East and Southeast Asia in 1995-2019: An integrated assessment using statistical methods, machine learning models, and multiple chemical transport models, submitted to ACP

Zanis, P., Akritidis, D., Turnock, S., Naik, V., Szopa, S., Georgoulias, A.K., Bauer, S.E., Deushi, M., Horowitz, L.W., Keeble, J. and Le Sager, P., 2022. Climate change penalty and benefit on surface ozone: a global perspective based on CMIP6 earth system models. Environmental Research Letters, 17(2), p.024014.