December 20, 2024

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

Climate Forcing due to Future Ozone Changes: An intercomparison of metrics and methods

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.

EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-3698
Discussion started Dec. 6, 2024
Discussion closes Jan. 17, 2025

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:

The paper begins with an excellent review of ozone radiative forcing, which will be a very helpful reference for the scientific community (especially Figure 1). Thank you.

Abstract.
Here the main findings on ozone RF are reported as:
"We find robust changes in ozone due to future changes in ozone precursors and ODSs. These lead to a positive radiative forcing of 0.27±0.09 Wm-2 ERF, 0.24 ± 0.021 W m-2 offline SARF, 0.29 ± 0.10 Wm-2 online IRF."
But to be clear, these numbers are the changes in RF between 2015 and 2050, correct? Should these results be reported as "delta ERF", for example?
Would ERF for 2050 be estimated as 0.47 +/- 0.23 W m-2 (from IPCC AR6) plus 0.27±0.09 W m-2 (this study), to equal 0.74 +/- 0.31 W m-2 ?

Line 74
It would helpful to provide a little more background on the SSP3-7.0 scenario, which is generally described as being driven by "regional rivalry". While NOx and CH4 emissions go up in this scenario through 2050 (see figure 6.18 of IPCC AR6 WG-I), there are clear regional differences, especially for NOx (see figure 6.19 of IPCC AR6 WG-I). For example, NOx emissions decrease quite strongly by 2050 in North America, Europe, Russia, Central Asia, and Pacific OECD.

The information in Figure 2 is a very handy reference, but I think it would work better as a table so you can list important items for each estimate such as: TOA vs tropopause, ERF vs IRF, starting and ending year. There seems to be an error in the mid-point of ozone RF for IPCC AR 2, which is plotted as 0.5 W m-2. However, Page 20 of IPCC AR2 states:
"Changes in tropospheric ozone have potentially important consequences for radiative forcing. The calculated global average radiative forcing due to the increased concentration since pre-industrial times is 0.4 (±0.2) Wm-2."

In terms of comparing the model output to observed ozone changes (1995 through 2021) a new paper by the HEGIFTOM Working Group will soon be available for open review on EGUsphere:

> Van Malderen, R., Z. Zang, K.-L. Chang, R. Bjorklund, O. R. Cooper, J. Liu, C. Vigouroux, E. Maillard Barras, I. Petropavlovskikh, T. Leblanc, V. Thouret, P. Wolff, P. Effertz, A. Gaudel, H.G.J. Smit, A. M. Thompson, R. M. Stauffer, D. E. Kollonige, D. Tarasick (2024), Global Ground-based Tropospheric Ozone Measurements: Regional tropospheric ozone column trends from the HEGIFTOM homogenized ground-based profile ozone datasets, submitted to ACP (TOAR-II Community Special Issue)

The analysis provides long-term ozone trends for many regions around the world, based on merged datasets (ozonesondes, lidar, IAGOS, FTIR). In my opinion, this is the best observation-based summary of global tropospheric ozone trends. The results are similar to the findings of IPCC AR6 (Gulev et al., 2021), except there is now evidence for a decrease of tropospheric column ozone in the Arctic, and there is a clear drop in ozone in 2020 and 2021 that coincides with the COVID-19 economic downturn.

Line 333
Please provide more information on the time-slice definition. Is this a 10-year time-slice centered on 2015 (i.e. averaged over 2010-2019)?

References

Gulev, S.K., P.W. Thorne, J. Ahn, F.J. Dentener, C.M. Domingues, S. Gerland, D. Gong, D.S. Kaufman, H.C. Nnamchi, J. Quaas, J.A. Rivera, S. Sathyendranath, S.L. Smith, B. Trewin, K. von Schuckmann, and R.S. Vose, 2021: Changing State of the Climate System. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 287–422, doi:10.1017/9781009157896.004