February 12, 2025

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

Intercomparison of global ground-level ozone datasets for health-relevant metrics

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EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-3723
Discussion started Jan. 3, 2025
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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:

Line 23
Is there any reason to report 60.8% with one decimal place? Would 61% be better, given the uncertainty in the estimate?
Response:
We agree. 61% is better.
Revised:
Line 23: "Among the six datasets, the population exposed to over 50 ppb varies from 61% to 99% in East Asia, 17% to 88% in North America, and 9% to 77% in Europe (2006–2016 average)."
Line 325: "Regional exposure estimates vary in East Asia, where the proportion of the population exposed to more than 50 ppb ranges from 61% in BME to over 90% in UKML, GEOS-Chem, and TCR-2."
Line 420: "In East Asia, exposure levels are consistently higher, with the percentage of the population affected ranging from 61% for BME to more than 90% for UKML, GEOS-Chem, and TCR-2 based on average OSDMA8 data over the same period."

Line 24
The following statement is not very clear:
"These differences are large enough to impact health and other applications."
I suggest:
"These differences are large enough to impact assessments of health impacts and other applications."
Response:
We agree and have changed to: "These differences are large enough to impact assessments of health impacts and other applications."
Revised:
Line 25: "These differences are large enough to impact assessments of health impacts and other applications."

Line 34
Please also provide the uncertainty range, along with the estimate of mortality.

Response:
We add the uncertainty range.
Revised:
Line 35: "The Global Burden of Disease 2021 (GBD) study estimated that ground-level ozone contributed to approximately 490,000 (95% UI: 107,000–837,000) global deaths in 2021, representing 0.72% (95% UI: 0.16% – 1.18%) of all deaths that year."

Line 38
Make it clear that these ozone increases refer to ozone above the surface (surface ozone was not reported in this study because the surface observations were from airport runways, which are not representative of typical conditions). When mentioning population-weighted metrics, Gaudel et al. (2020) is not a correct reference as it does not address these metrics. Please provide a different reference. It would be helpful to list some references that provide recent updates on surface ozone trends. One such paper is Chang et al. (2024), submitted to the TOAR-II special issue, which focuses on long-term surface ozone trends across the USA.

Response:
We clarify that tropospheric ozone refers to ozone above the surface and included Chang et al. (2024) as a reference for the surface ozone trend in the U.S.
Revised:
Line 40: "Gaudel et al. find that since the mid-1990s, tropospheric ozone above the surface has

increased across all 11 study regions in the Northern Hemisphere that they defined and analyzed (Western North America, Eastern North America, Southeast North America, Northern South America, Northeast China/Korea, The Persian Gulf, India, Southeast Asia, Malaysia/Indonesia, Europe, Gulf of Guinea) (Gaudel et al., 2020). In the United States, although extreme ground-level ozone concentrations have declined, winter ground-level ozone concentrations have increased in Southwest and Midwest regions since 1990s (Chang et al., 2024)."

Line 243-244

It is an oversimplification to say that ozone is typically increasing in the northern hemisphere over 2005-2016. First you need to specifically state that you are talking about the OSDMA8 metric, which is very different from the metrics reported by Gaudel et al (2018) and Fleming et al. (2018). These earlier studies showed a range of increasing and decreasing ozone trends that varied by region. The recent trend update by Chang et al. (2024) shows decreasing ozone in the eastern and western USA over the period 2005-2016. I recommend that you refer to studies that have focused on OSDMA8, such as Becker et al., 2023, and Malashock et al., 2022 (see Figure 1 and Figure 2 of Malashock et al., 2022; note that this is the second paper by Malashock, published in 2022; see the reference listed below).

Response:

We delete the sentences reference to Gaudel et al (2018) and Fleming et al. (2018) in this paragraph. Since both Becker et al., 2023, and Malashock et al., 2022 are using the BME dataset, they do not provide independent analysis. We cite Chang et al 2024 in the regional trend comparison part.

Revised:

Line 277: "Recent analyses using TOAR observations indicate that from 2006 to 2016, most sites in North America experienced decreasing ozone, while many sites in East Asia exhibited significant positive trends (Chang et al., 2024; Fleming et al., 2018; Chang et al., 2017)."

Line 509

According to the TOAR data use policy (https://toar-data.fz-juelich.de/footer/terms-of-use.html), the TOAR data also needs the following citation:
Schröder et al; TOAR Data Infrastructure;
https://doi.org/10.34730/4d9a287dec0b42f1aa6d244de8f19eb3

Response:

We have added a citation to this reference.

Revised：

Line 190: "For the evaluation in this project, we utilized both urban and non-urban ground-level ozone observations for the yearly OSDMA8 metric from the updated TOAR-II dataset, covering 2006 to 2016 (Schröder et al., 2021)."
Line 527: "Observational data are publicly available from the TOAR-II data portal (last accessed on 15 November 2024, toar-data.org) (Schröder et al., 2021). "

Figure 1

Following the TOAR-II statistical guidelines, all trends need to be reported with their 95% confidence intervals and *p*-values.

Response:

We added 95% UI to 3 new tables (Tables 2, Table S11, Table S13) presenting trends in the main body and SI, and modified the description.

Revised：

Line 22: "For example, in Europe, the two chemical reanalyses show an increasing trend while the other datasets show no increase."
Line 263: "In Table 2, focusing on the period from 2006 to 2016, we find that NJML is the only dataset

showing a downward trend in both area-weighted and population-weighted mean ozone concentrations, with very high certainty. In contrast, TCR-2 and UKML show increasing trends in population-weighted mean ozone during this period with very high certainty."
Line 275: "From Table S11, we observe that some regions exhibit a clearer trend from 2006 to 2016, with very high certainty across six datasets. In East Asia, BME and NJML observe decreasing trends, whereas the other 4 datasets display increasing trends. In North America, all datasets display a downward trend, and in Europe, BME, NJML, UKML and TCR-2 show a decline, contrasting with increases in CAMS and GEOS-chem datasets. Recent analyses using TOAR observations indicate that from 2005 to 2016, most of North America sites experienced decreasing ozone, while many sites in East Asia exhibited significant positive trends."
Line 415: "NJML demonstrates a decreasing trend in global population-weighted and area-weighted yearly mean over the 2006-2016 period, while the five others exhibit either increasing trends or no clear trend."
Line 499: "Regionally, all datasets show a downward trend in North America, and only BME and NJML datasets demonstrate a downward trend in East Asia; In Europe, BME, UKML, NJML and TCR-2 report a downward trend, while the other two chemical reanalysis datasets reveal an upward trend that is not seen in observations."

Figure 7
These figures need to be reoriented, with the TOAR-II observation being the independent variable on the x-axis, and the model output being the dependent variable on the y-axis.
Response:
We change Figure 7 to show the TOAR-II observations on the x-axis.

References

Chang, K.-L., McDonald, B. C., and Cooper, O. R. (2024), Surface ozone trend variability across the United States and the impact of heatwaves (1990–2023), EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-3674 (submitted to ACP as a contribution to the TOAR-II Community Special Issue)

Malashock, Daniel A., Marissa N. Delang, Jacob S. Becker, Marc L. Serre, J. Jason West, Kai-Lan Chang, Owen R. Cooper, Susan C. Anenberg (2022), Global Trends in Ozone Concentration and Attributable Mortality for Urban, Peri-Urban and Rural Areas between 2000 and 2019: A Modelling Study, The Lancet Planetary Health, Volume 6, Issue 12, Pages E958-E967, https://doi.org/10.1016/S2542-5196(22)00260-1