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

Changes in South American Surface Ozone Trends: Exploring the Influences of Precursors and Extreme Events

Seguel, R. J., Castillo, L., Opazo, C., Rojas, N. Y., Nogueira, T., Cazorla, M., Gavidia-Calderón, M., Gallardo, L., Garreaud, R., Carrasco-Escaff, T., and Elshorbany, Y.

EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-328, 2024.
Discussion started: 12 Feb 2024; Discussion closes March 25, 2024

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.

Guidance note on best statistical for TOAR 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:

The authors have provided the first continent-wide overview of surface ozone across South America, based on all available observations. This is an important topic and a welcome addition to the TOAR-II Community Special Issue. The trend analysis is extremely well done, and the authors have done a very good job of following the recommendations from the "Guidance note on best statistical for TOAR analyses". In particular the use of the TOAR vector approach for visualizing trends and the use of the TOAR color table makes it very easy to compare these new TOAR results to previous TOAR studies.

Overall the findings are consistent with the papers from TOAR-I and with the papers submitted so far to the TOAR-II Community Special Issue. A paper that is currently under review with the TOAR-II Community Special Issue reports boundary layer and free tropospheric ozone observations across the tropics based on IAGOS commercial aircraft and ozonesondes. It would be helpful if the authors could briefly discuss how their findings are relevant to these other new results, or how the ozone values in the free troposphere (reported by Gaudel et al., 2024) might affect the surface sites:

Gaudel, A., Bourgeois, I., Li, M., Chang, K.-L., Ziemke, J., Sauvage, B., Stauffer, R. M., Thompson, A. M., Kollonige, D. E., Smith, N., Hubert, D., Keppens, A., Cuesta, J., Heue, K.-P., Veefkind, P., Aikin, K., Peischl, J., Thompson, C. R., Ryerson, T. B., Frost, G. J., McDonald, B. C., and Cooper, O. R.: Tropical tropospheric ozone distribution and trends from in situ and satellite data, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2023-3095, 2024.

Mixing ratios are reported in units of ppbv, however, Copernicus journals require units of nmol mol^{-1}.

Line 358
Tololo is mentioned in the Conclusions and acknowledged as being a valuable monitoring station, but it is not mentioned much in the main text. A figure showing the full Tololo time series, along with its change points (e.g. Figure 7a), would be very helpful and would clearly illustrate the shifts in background ozone.

Data Availability statement:
Please provide additional details that will allow the reader to find the data.
1) provide a link to the TOAR-II surface ozone database
2) provide a link to the MODIS data
3) Figure B1 shows observations of CO and NOx. Are these data available from the TOAR database?
4) to acknowledge the WMO GAW program, please also provide a link to the location where GAW data can be downloaded: https://ebas.nilu.no/

Minor Comments:

Abstract: The way the first sentence is written, the subject of the sentence is “trends” and not “ozone”. Therefore, the word “precursors” refers to trends, and not ozone. A better way to phrase the sentence is:
“In this study, trends of 21st-century ground-level ozone and ozone precursors were examined across South America, an understudied region where trend estimates have rarely been comprehensively addressed.”

Introduction, first paragraph:
Section 2.2.5.3 in Chapter 2 of IPCC AR6 (Gulev et al., 2021) provides a concise summary of global tropospheric ozone trends, based on the TOAR findings. I recommend that the IPCC findings be used as the starting point for the trend discussion in the submitted manuscript:
“Since the mid-1990s, free tropospheric ozone has increased by 2–7% per decade in most regions of the northern mid-latitudes, and 2–12% per decade in the sampled regions of the northern and southern tropics (high confidence). Limited coverage by surface observations precludes identification of zonal trends in the SH, while observations of tropospheric column ozone indicate increases of less than 5% per decade at southern mid-latitudes (medium confidence).”

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

Line 48
When summarizing ozone standards, the averaging time should also be given. For example, do the values 51-71 ppbv refer to the maximum daily 8-hour average?

Line 59
Please specify that GAW is a WMO program.

Line 104
The WHO AQ guidelines report is missing from the list of references:
WHO global air quality guidelines. Particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. Geneva: World Health Organization; 2021. Licence:
CC BY-NC-SA 3.0 IGO.

Line 220
Ozone increased at Tololo from 2006 to 2014 by about 2.3 ppbv. The discussion seems to imply that this increase of ozone is due to the increase of methane over the period 2006-2014. The observed methane increase from 2006 to 2014 (according to NOAA GML: https://gml.noaa.gov/ccgg/trends_ch4/) was about 50 ppbv, or about 3%. While methane drives the background increase in ozone, are there any modelling results that can support this suggestion? A recent submission to the TOAR-II Community Special Issue (Nalam et al., 2024) calculates the change in global surface ozone due to methane increases over the period 2000-2018. For the period 2006-2014, Figure 7b, indicates an ozone increase of no more than 1 ppbv.

Nalam, A., Lupascu, A., Ansari, T., and Butler, T.: Regional and sectoral contributions of NOx and reactive carbon emission sources to global trends in tropospheric ozone during the 2000–2018 period, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2024-432, 2024.

Table 1
Please check the greater-than-or-equal-to symbols in this table against the original Table 3 in the “Guidance note on best statistical for TOAR analyses”. Many of these symbols don’t match the original table.

Figure B1
For those of us not highly familiar with the geography of Chile, it’s not clear that the cluster of observing stations near the top of the map is located in the Santiago urban area. Can this be indicated on the map?