Response to the Community Comment by Rodrigo J. Seguel

Comments by Rodrigo J. Seguel on behalf of the TOAR-II Steering Committee on:
Tropical tropospheric ozone distribution and trends from in situ and satellite data
Audrey Gaudel (corresponding author), Ilann Bourgeois, Meng Li, Kai-Lan Chang, Jerald Ziemke, Bastien Sauvage, Ryan M. Stauffer, Anne M. Thompson, Debra E. Kollonige, Nadia Smith, Daan Hubert, Arno Keppens, Juan Cuesta, Klaus-Peter Heue, Pepijn Veefkind, Kenneth Aikin, Jeff Peischl, Chelsea R. Thompson, Thomas B. Ryerson, Gregory J. Frost, Brian C. McDonald, Owen R. Cooper
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Discussion started: 22 January 2024; discussion closes 18 April 2024
This review is by Rodrigo Seguel, member of the TOAR-II Steering Committee. 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 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.

We would like to thank Dr. Rodrigo Seguel for this comprehensive summary of the paper. Our responses to his comments are found below in bold text.

General comments
The authors have assessed the distribution and trends of tropical tropospheric ozone using available ozone profiles measured by a suite of in situ instruments (IAGOS commercial aircraft, the SHADOZ network, and the ATom aircraft campaign) and six satellite records of tropical tropospheric column ozone (TROPOMI, OMI, OMI/MLS, OMPS/MERRA2, CrIS, and IASI/GOME2). The authors have performed a great job of enhancing the trend detectability and comparability of different data sources and also provided a thorough discussion about bias between satellite and in situ data.
In particular, given the sparsity of the in-situ sampling over the tropics (time and space), SHADOZ and IAGOS measurements were fused over some regions to enhance the trend detection, which is based on quantile regression, as suggested by TOAR-II guidelines (TOAR-II Recommendations for Statistical Analysis). Also, the ozone profiles from in situ observations were converted to columns to evaluate the satellite products and adjust the satellite biases, thus allowing the reduction of the satellite differences in the tropical tropospheric ozone burden (TTOB).
Overall, the findings are consistent with the papers from TOAR-I and the papers submitted to the TOAR-II Community Special Issue. In this regard, the low ozone levels found over the Americas are consistent with the relatively low ozone mixing ratios measured at ground level in the South American tropics compared with South American extratropics values reported in: https://doi.org/10.5194/egusphere-2024-328

Minor comments

In section 2 (Methods), the authors clearly define the latitudinal band corresponding to the tropics for this study, which also follows the TOAR-II recommendation (TOAR-II Community Special Issue Guidelines). However, in lines **124** and **132**, they refer to the tropics between 30º S and 30º N, which includes the subtropics. For consistency, I suggest changing "tropics" to "tropics and subtropics," similar to line **101**.

Thank you for this comment. We updated the lines 124 and 132 accordingly.

Line 215-2016 (Caption of Figure 1): Please change "Africa, South Asia" to "Western Africa, India"

Changed

Line 257: Do you mean the disagreement is within ± 2%?

We rephrased the sentence as follow: "*In comparisons of the reprocessed data with collocated total ozone spectrometers and satellite overpasses, the reprocessed SHADOZ total ozone column (TOC) disagreed with the independent data within 2% (Thompson et al., 2017).*"

Line 283: Please check the parenthesis.

The parenthesis are correct.

Line 699: Change "cannow" to "can now"

Changed

Line 894-896 (Conclusions): In addition to the processes described by Kley et al. (1996), are there any other relevant processes that explain the low ozone values found in the Americas and the tropical South Pacific that may be suitable to discuss?

The low ozone values in the lower troposphere measured above the Americas are mostly observed in the measurements above San Cristobal from the SHADOZ network and the Americas IAGOS region is mostly driven by measurements above Caracas (Venezuela) and Bogota (Columbia).

Oltmans et al. (1999) suggest that the lower values of ozone above San Cristobal may be explained by both strong ozone sink in the vicinity of the marine boundary layer as well as convection, the same mechanisms as above the Western Pacific and described in Kley et al. (1996). Above Caracas, low ozone levels close to the surface were already reported in Yamasoe et al. (2015) using IAGOS data. They show that except in the March-April-May season, most of the sources of ozone in Caracas are local. Sanhueza et al. (1999) show low levels of surface ozone in the south of Caracas during the wet season (May-December). Seguel et al. (2024) report lower ozone exposure (MDA8 health metric) in Bogota and Quito than other South American sites, which could be explained by intense vertical mixing as observed in Quito (Cazorla et al., 2021a; Cazorla, 2017).

We added this discussion in the manuscript as follow:

“Ozone levels are lowest above the tropical South Pacific (dark blue lines on the SHADOZ and ATom panels of Figure 2) and the Americas (IAGOS: mostly represented by measurements above Caracas and Bogota, and SHADOZ: San Cristobal, purple lines on both panels of Figure 2), with the 5th percentile below 10 nmol mol-1, particularly in the lower troposphere. These low ozone values are due to the ozone sink near the marine boundary layer coupled with deep convection above the tropical South Pacific (Kley et al., 1996) and San Cristobal (Oltmans et al., 1999). Above Caracas, the local influence is notable, with low ozone levels observed during the wet season (May-December) (Yamasoe et al, 2015; Sanhueza et al., 1999). Additionally, Seguel et al. (2024) report lower ozone exposure (MDA8 health metric) in Bogota and Quito than in other South American sites, likely due to intense vertical mixing as observed in Quito (Cazorla et al., 2021a; Cazorla, 2017).”