Atmospheric Chemistry and Physics Discussions

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Comment on acp-2021-278

Anonymous Referee #1

Referee comment on "In situ ozone production is highly sensitive to volatile organic compounds in Delhi, India" by Beth S. Nelson et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-278-RC1, 2021

The authors have written a thorough analysis of the factors controlling ozone in the heavily polluted city of Delhi. The study is based on a wide range of ozone precursor gases measured during a one-month period in 2018. I find the paper to be generally well-written and the conclusions are supported by the observations and the box modelling. Below I have provided a few comments to improve the study, which can be handled with a minor revision. I recommend the paper be published in ACP once my comments have been addressed.

Major comments:

1) The background material in the Introduction is largely out of date and here I list some references that provide a current assessment of ozone's distribution and trends. When discussing the impacts of ozone on human health, Jerrett et al. is a good reference, but it's quite old. Fleming et al. 2018 from the Tropospheric Ozone Assessment Report (TOAR) provide an overview of ozone's health impacts. In terms of ozone increases since the mid- 20th century, the earlier findings of Parrish et al. 2014 have now been superseded by Tarasick et al. (2019) (from TOAR). Since the 1990s, surface ozone trends vary by region (Gaudel et al., 2018; Cooper et al., 2020; Lu et al., 2020), but in the free troposphere trends since the 1990s have been overwhelmingly positive (Gaudel et al., 2020; Liao et al., 2020; also see the review by Cooper et al., 2020). The paper by Ni et al. (2018) is not a good reference regarding ozone trends as it only focuses on a single year (2008). A good paper that shows the increases of ozone across China is Lu et al. 2020.

2) According to the ACP/Copernicus Data Policy, the paper needs to include a "Data availability" section, as follows:

Authors are required to provide a statement on how their underlying research data can be accessed. This must be placed as the section "Data availability" at the end of the manuscript. Please see the manuscript preparation guidelines for authors for the correct sequence. If the data are not publicly accessible, a detailed explanation of why this is the case is required. The best way to provide access to data is by depositing them (as well as related metadata) in FAIR-aligned reliable public data repositories, assigning digital object identifiers, and properly citing data sets as individual contributions.

The authors have not provided a "Data availability" section, which needs to be addressed before the paper can be published. Further details are available here:

https://www.atmospheric-chemistry-and-physics.net/policies/data_policy.html

3) The authors conducted a range of sensitivity tests to understand the response of ozone production to changes in NOx and VOCs. However, an air quality manager who is tasked with keeping ozone levels below the Indian ozone standard of 50 ppbv needs more information. They need to know how much they need to cut NOx and VOCs in order to keep the maximum daily 8-hour average below 50 ppbv. To make the study more relevant to air quality management the authors should experiment with their box model to find a range of NOx and VOC mixing ratios that will keep ozone below 50 ppbv.

Minor comments:

Line 53

Here ozone is described as an important greenhouse gas in the mid-troposphere. However, ozone acts as a greenhouse gas throughout the depth of the troposphere, with a maximum radiative impact in the upper troposphere. See Figure 1 in the Supplement of Skeie et al., 2020.

Line 64

"cocktail" is a fine analogy for conversational discussions, but not for a scientific paper. Use something like "range" instead.

Line 75

The presentation of basic ozone photochemistry should include a reference

Line 96

Shouldn't but-2-enes be 2-butenes?

Here is the relevant passage from Ran et al., 2011:

“The most reactive species responsible for ozone formation are mainly alkenes and aromatics such as

2-butenes (18 %), isoprene (15 %), trimethylbenzenes (11 %), xylenes (8.5 %) and toluene (4.5 %).”

Line 104

A reference is needed for the statement on personal care products. McDonald et al. (2018) is a good one.

Line 105

A reference is needed for this statement:

“Understanding which precursor species are key to O3 production in any given city allows governments to introduce measures to combat air quality problems.”

Line 135

“was attributed” should be “were attributed”

Line 136

I don’t think I’ve ever heard of the term “deweathered”. Do you mean to say that meteorological biases were removed?

Line 182

high should be height

Line 367

Here you state that the observations “suggest” that the standard was exceeded on 16 days. But to say “suggest” implies that you aren’t really sure. However, your measurements show that the standard was definitely exceeded on 16 days, and you should rephrase the sentence so that it reflects your confidence in your observations.

Line 369

Again, why use the word “suggest”? An official government document should clearly state the policy, with no ambiguity.

Line 444

On line 348 the ozone peak is stated to occur at 13:00, but here the peak is stated to occur at 12:00. Please reconcile.

Line 495

There seems to be a typo in the following sentence in the caption to Figure 9:

"The red diamond represents at point 1,1 represents modelled P(O3) at observed VOC and NOx concentrations."

Line 573

Delete "the" before prevalence

Line 658

"represents and aggregate" should be "represents an aggregate"

References:

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