Comment on acp-2022-592

Anonymous Referee #1

Referee comment on "O3-precursor relationship over multiple patterns of time scale: A case study in Zibo, Shandong Province, China" by Zhensen Zheng et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-592-RC1, 2022

Comments on "O3-precursor relationship over multiple patterns of time scale: A case study in Zibo, Shandong Province, China"

General comments:

Based on 5-month observation data of VOCs, CO, NOx and meteorological factors at three sites in a major prefecture-level city of Zibo, Shandong province of China, this manuscript explored the relationship between O3 and its two precursors (VOCs and NOx) by using a 0-D box model. The results implied that diagnosis of photochemical O3 formation regimes was better based on model simulations with constrain of the observation data on shorter time scales (e.g., daily or weekly scales), which would have a certain significance for developing O3 control strategies in different pollution areas. To my knowledge, there are few studies to comparably investigate the difference of photochemical O3 formation regimes diagnosed by model simulations with input of observation data treated on different time scales. Therefore, this reviewer recommends the manuscript to be published in the journal after considering the following specifics.

Specifics:

There are many grammar mistakes, repetitive specifications and unclear descriptions

thorough the whole manuscript, and thus an English native speaker is suggested to polish the manuscript.

The results and discussion seemed to be very confused for discussing the results at the three sites on the four-time scales. As the topic of this manuscript is "O3-precursor relationship over multiple patterns of time scale", the investigation is better focused on the observation data at one sampling site, rather than at the three sampling sites.

Abstract:

Line 24-27, the subject of "reactivity" doesn't match the predicate of "were" in this sentence; "time scale" is better replaced by "time scales"; "varied from wider and narrower" is better moved before the parentheses. This sentence seemed to be vague, and thus is better to be rephrased.

Lines 28-30, "The time series of the photochemical regime" seemed not match "magnitude".

Introduction:

Lines 52-54, "the non-linearity of ozone pollution and complex process involved in it" should be "the complex non-linear relationship between O3 formation and its precursors (VOCs and NOx)"; "challenges" doesn't match "lies".

Lines 61-65, the large spatiotemporal variability of O3-precursor relationship has been widely reported in literature, rather than a finding of your recent study. Therefore, this sentence is better to be rephrased.

Methods:

Lines 107-112; 119-127; 128-137, why did you describe the VOCs measurements in three paragraphs? The time resolution of VOCs measurements was repeated for three times. The description of "a FID detector is applied for quantification" is not correct. The FID detector can only detect the signal of target species, rather than quantification of the targets. Why did you respectively select Tenax GR to pre-concentrate C6-C12 VOCs and C2-C6 VOCs for the GC-FID and the GC/FID/PID? Could the Tenax GR effectively capture C2-C6 VOCs at room temperature? What's the role of PID for the GC/FID/PID? How about variations of the retention times of VOCs during the monthly calibration period?

Lines 138-145, besides the calibration, field comparison for the VOCs measurements by using the two types of GCs at one of the tree sites is most important for the QA/QC. Did you conduct the comparison?

Lines 163-165, "for the best reproduction of O3" at the end of this sentence.

Lines 177-179, the subject of "dataset" doesn't match the predicate of "were"; Considering the repetition for classifying the four patterns of time scale, this sentence is suggested to "Specifically, the entire campaign data classified as four patterns of time scale were modeled as base runs.".

Lines 211-216, to avoid confusing between the species of X and its concentration, POx(X) and POx(X-DX) are suggested to be POx(C_X) and POx(C_X-DC_X); either "(ΔX, 10% of X in this study in accordance with the previous studies" or "Therefore, ΔC(X)/C(X) was 10% in this study" can be deleted to avoid repetition.

Results and discussion:

Line 245, "within" should be "among".

Lines 247-250, the bracket is suggested to be moved after alkene*.

Lines 254-257, why were the nocturnal O3 concentrations significantly underestimated by the model simulations (e.g., Fig. S3)?

Lines 280-287, why was the model performance for TZ better than for XD and BJ?

Line 292, alkenes* have been noted before, and thus the brackets in here can be deleted.

Lines 309-313, the relationship between the monthly variations of the species and the RIR

is better to be discussed, or readers cannot understand why you present them in here?

Lines 314-316, "two regimes (i.e., VOC-limited and NOx-limited) or" can be deleted because the three regimes are prevailingly adopted.

Lines 326-328, the correlation between the monthly TVOC/NOx and RIRNOx/RIRAVOC would became worse when only one sampling site was considered. Therefore, Fig. 5b could not well explain the considerable variation of monthly O3 formation chemistry.

Lines 344-347, the correlation between the weekly TVOC/NOx and RIRNOx/RIRAVOC at one sampling site (Fig. 5c) was also weak for explaining the weekly variation of O3 formation chemistry. Additionally, the data point with TVOC/NOx of zero for BJ in Fig. 5d is wrong, should be removed.

Lines 361-363, the description seemed not well reflect the time series of daily RIRNOx/RIRAVOC in Fig. S11 with irregular variations.

Lines 399-402, the model simulations with inputting the average values for the five-month scale would greatly mask the large temporal variations of species especially for meteorological factors (such as sunlight and temperature), which is the key reason for the discrepancy of RIR values between five-month scale and daily scale. It is not proper to explain the discrepancy of RIR by the uncertainty.

Lines 415-418, there is a repeated comparison.

Line 460, besides the analyzed uncertainties, the uncertainty due variation of meteorological factors for the long period scales may play a more important role in the O3 sensitive chemistry.