

Main comments:

In recent years, ozone pollution has become an increasingly serious problem in China. Analyzing the causes of ozone pollution is of great help in its treatment. This study investigated the impact of extreme weather on ozone pollution in the Pearl River Delta, South China, with field measurements, machine learning, and model simulations, and highlighted the significant impact of Natural Processes. The results show that weather-induced natural processes, including meteorological factors, BVOCs emissions, STE processes and atmospheric transportations provide substantial contributions to the prolonged O₃ pollutions. Particularly, investigation was made upon BVOC chemical pathway with O₃ production more attributable to the further degradation of isoprene oxidation products than the direct isoprene oxidation, which presents to be an important mechanism of isoprene contributing to ozone formation. Overall, this study is well organized, and can provide insights for ozone control under global warming. I suggest the paper could be accepted for ACP publication after addressing the following suggestions.

Specific comments:

1. Abstract, “isoprene and biogenic formaldehyde accounted for about half of the in-situ O₃ production.” What’s the mean of “about half of the in-situ O₃ production”? Does this mean that for ozone production, isoprene and biogenic formaldehyde contributes 50%? How much does the increase in BVOC emissions due to high temperatures affect ozone production compared to normal years? In addition, the conclusion of the article is not clear. The author analyzed the meteorological factors, BVOCs emissions, STE processes, and atmospheric transportations, but which one is the most important process?
2. Page 3, Line 66, Change “biogenic volatile carbon” to “biogenic volatile organic compound”
3. Page 3, Line 66, The author sometimes uses “BVOC” and sometimes uses “BVOCs” in the manuscript, please unify the abbreviation of “BVOC” throughout the text.
4. Page 3, Line 70-75, Suggesting additional references in these sentences, for example, Lyu et al. (2023), <https://doi.org/10.1016/j.oneear.2023.07.004>.
5. In Section 2.1, please provide the time period of the field campaign at the HZ base.
6. Page 5, Line 127, how was the “regional O₃ exceedance” defined?
7. Page 5, Line 151, Please give more detailed introduction of the detection of VOC species, i.e., how many species?
8. In Section 2.3, 2.4 and 2.5, when you introduce the model of LPDM, MEGAN and

the F0AM, please provide the official website of the model if it is available.

9. Page 8, Line 229, “WRF-CMAQ” or “WRF” here? Line 231, which one does "the model" refer to?
10. Page 9, The author compared the model simulated O₃ with AIRS data. In addition to the direct objective comparison analysis, it is suggested to provide a statistical result of the comparison, for example, what's the correlation coefficient between them?
11. Page 12, Lines 357-368, This part needs to be compared to the normal years? BVOC emissions increased by 10% compared to the normal years, how about its contribution to O₃ production?
12. BVOC emissions are important natural sources of ambient O₃, the author could use a few words to discuss the diurnal characteristics of isoprene measured at HZ base.
13. Why you use 10% hypothetical case to simulate the isoprene chemical pathway?
14. Page 13 “Hence, the impacts of BVOC oxidation intermediates on downwind air quality warrant more attention” this conclusion also needs references to support.
15. Figure 4, it is interesting to see that the authors provide the detailed chemical pathway of isoprene chemistry. I suggest that the author improve the figure by adding a quantified result of how much contribution is from isoprene direct contribution to O₃ and how much contribution is via the further degradation of early generation isoprene oxidation products to O₃.
16. “STE” has already defined in the previous texts, so you should use “STE” here, instead of using “stratosphere-to-troposphere exchange”. Attentions should be paid in similar places throughout the manuscript.
17. In the Section of Conclusion, it is suggested to provide the quantified contribution of BVOC emissions to O₃ formation. So that readers could clearly get the main result of the study.
18. In the caption of Figure 2, please define the abbreviation of T₂, BLH, RH, WS, U₁₀, w, U₈₅₀, TCC, V₁₀ and V₈₅₀
19. In Figure 3, the caption “HCHO (B_HCHO)” should be “biogenic HCHO (B_HCHO)”.
20. In the caption of Figure 7, please define the abbreviation of ISOP, MVK and MARC.