Review of "The long-term impact of BVOC emissions on urban ozone patterns over central Europe: contributions from urban and rural vegetation"
Manuscript ID: egusphere-2024-2027

General comments:
The authors explored the impact of urban BVOC emissions on atmospheric oxidants, including O3, HCHO and OH, over a decade (2007-2016) in central Europe by using the MEGAN model and WRF-CMAx. However, in the results and discussions, the authors have discussed the impact of BVOCs emissions in the past decade by averaging them, which ignores the annual changes in BVOCs emissions caused by variation in meteorology, land type, and vegetation during the year 2007-2016, and the impact of these changes on the concentrations of atmospheric oxidants. This is also inconsistent with the "long-term impact of BVOC emissions" which proposed in the manuscript title. Long-term changes in BVOCs emissions and their impact on atmospheric oxidant concentrations over decadal periods should be of interest.
In addition, the MEGAN model used in this study to calculate BVOCs emissions should not only consider the impact of the changes in meteorological fields which provided by the WRF model, but also consider the changes in land type, LAI, and vegetation type. This may lead to uncertainty in the estimated BVOCs emissions, and thus affect the estimation of its contribution to atmospheric oxidants concentrations. The authors should discuss the uncertainties in the BVOCs estimated by MEGAN model and the WRF input data, and the impact of these uncertainties on evaluating the impact of urban BVOCs on ozone.
The figures in the current manuscript should be further integrated and optimized. The discussion and conclusion section should present the discussion and outlook of the current research work, rather than repeating the results of the manuscript. This section seems too long, should further summarize the findings and conclusions.
Overall, the research content of this manuscript is quite interesting and is currently a hotspot in the field. However, the writing and figures need improvement to meet the ACP journal's standards. The current version of this manuscript requires major revisions before it can be considered for publication.

Specific comments:
1. Line 72: The first time an OSAT appears, its full name should be provided.
2. Line 79-80: It is mentioned here that the interplay of anthropogenic and biogenic VOC emissions is synergic. How anthropogenic VOC emissions and the interplay between them were considered in setting up model experiments in this study?
3. Line 82-83: "The dominant role of natural VOC emissions over anthropogenic ones", what does this mean?
4. Line 81-93: The literature listed here seems messy and illogical. We suggest that the author need to further improve the introduction section. Also, there are studies on the impact of BVOC emissions on air quality in urban in China, such as Ma et al. (2021). Authors should consider when conducting literature research.
   Reference: Ma, M., Gao, Y., Ding, A., Su, H., Liao, H., Wang, S., ... & Gao, H. (2021). Development and assessment of a high-resolution biogenic emission

inventory from urban green spaces in China. Environmental science & technology, 56(1), 175-184.

5. Line 194-207: For MEGAN model, what are the specific land cover types used in the model? What is the data source and the base year of land cover types? The authors focus on ten years (2007-2016). Does the land cover type change during this decade? Does the MEGAN model consider the impact of changes in land type on BVOC emissions? If there is a difference between the base year of land cover types and the study year, will this difference affect the calculation of BVOC emissions?

   What are the criteria for matching land cover types with vegetation types in MEGAN?

   Are the soil temperature and soil moisture provided by the WRF simulated results? Are there any biases between the soil temperature and moisture simulated by the model and observations? How much uncertainty will these biases lead to the simulation of BVOC emissions? For CO2 concentration in MEGAN model, does it a fixed value or something else?
6. Line 254: Should use BVOC or biogenic VOC? The author needs to unify.
7. Line 255-266: The authors compared the BVOC emissions calculated by MEGAN and CAMS-GLOB-BIO. What are the differences in the parameterization schemes for calculating BVOC emissions? If the differences are only due to land cover type and meteorological fields, the authors should provide more detailed explanations on how the differences in meteorological fields affect the simulated BVOC emissions.
8. Line 278-280: Does “2nuBVOC” and “0.5nuBVOC” mean changing the fraction of BVOC emissions in urban areas within the grid? How are BVOC emissions in urban and nonurban areas defined in this study?
9. Line 305: Need to mark Figure 5 in this paragraph. Also, the title of Figure 5 should indicate that it is the average over the 10 years (2007-2016).
10. Line 317: Does the 2-5 here mean 2-5%?
11. Line 318-325: For Figure 6, how does the impact of BVOC emissions on ozone change between different seasons from the year 2007 to 2016? It is recommended that the author provide the average annual changes in the impacts during different seasons in year 2007-2016.
12. Line 326-353: The impact of BVOC on ozone, formaldehyde and OH over city surrounding and urban centers are both kind of different, which can be further explained based on the differences in BVOC emissions and distribution.
13. Line 355-368: The author plot both Figure 10 and Figure 11. I can understand that Figure 10 shows the contribution of urban BVOCs to O3, HCHO and OH concentrations, while Figure 11 shows the impact of urban BVOCs on these pollutants. However, the author did not figure out why Figures 10 and 11 have different distribution of contributions and impact on O3. Also, there seems to be no difference between these two calculation methods for HCHO and OH.
14. For Figure 12-14, suggest author recompose these figures. The current figures are difficult to understand the impact of urban BVOCs emissions between city centres

and city vicinities.

15. Line 384-391: What does the meaning of “relative share”.
16. It is difficult to tell from the colorbar in Figure 15-17 whether it is a positive or negative contribution or impact of urban BVOCs. The author can represent positive contributions with warm colors and negative contributions with cool colors.
17. Line 421-422: According to Figure 18, the legends are all positive values. How can you conclude that the urban BVOC emissions have decreased by 50% compared to the default case?
18. Line 527: Is the difference in urban BVOC emissions between the two calculations just a difference from BVOC emissions?