Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2022-467-RC2, 2022
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Comment on acp-2022-467

Anonymous Referee #2

Referee comment on "Characterization of volatile organic compounds and submicron organic aerosol in a traffic environment" by Sanna Saarikoski et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-467-RC2, 2022

This study investigated the variation and composition of VOCs and SOA in urban street canyons using various observation instruments. The study provides some helpful information about the source apportionment and aging mechanism of SOA, which can be of considerable interest to readers. This manuscript has the potential to be published in the ACP. However, it has severe structural issues and requires a more sophisticated analysis of the results.

General comments

First, the subject of this manuscript is not clear. In Chapter 3.2, the source identification of SOA was investigated, focusing on diurnal variations. In contrast, in Chapter 3.3, the subject suddenly changed to a case study and the focus shifted to the size distribution of aerosols. In Chapter 3.4, the topic changed to the oxidation of VOCs and the generation of SOA. Chapter 3.4.1 analyzed the oxidation contributions of VOCs based on daily variability, while Chapter 3.4.2 focused again on the diurnal variability of SOA oxidation. This flow is discontinuous and disconnected, resulting in a lack of cogency. Therefore, the structure of this manuscript needs to be reorganized extensively, and some content needs to be omitted. This lack of uniformity also resulted in the abstract and conclusion being extensively long, which needs to be corrected.

Second, most of the interpretation in this manuscript relies on a PMF analysis. PMF has many advantages, but it does not guarantee unique decomposition, and the basis functions can show substantially different patterns depending on the number of basis. In addition, even if the sum of the variabilities of the basis functions explains the data satisfactorily, individual basis functions may not be scientifically significant. Multiple sources may be included in one base function, or conversely, one source may be divided into several basis functions. Therefore, individual base functions must be interpreted cautiously, and the PMF analysis must be validated. The PMF analysis in this study also included certain critical errors. For example, even though the coffee roaster is 600 m

away, the CoOA explains 7% of OA on average, which is 30% of the POA caused by traffic and biomass burning (HOA-1, 2). In some periods, CoOA even constitutes 80% of the total OA. This result is not acceptable from a general point of view. Therefore, it is necessary to accurately diagnose the limitations and issues of the current PMF analysis, and these results must be presented in the paper to increase the reliability of the results.

Specific comments

- Title: Why is an urban canyon being considered? The manuscript does not present information on the characteristics of the urban canyon.
- Line 213: What is the concentration of OA in the two excluded periods? If PM and OA concentration information for the excluded period is also provided, it will improve readers' understanding.
- Chapter 3.1.1: A map of the campaign region should be provided to understand the characteristics of the region, the dispersion of nearby sources, and the vortex structure by canyon geometry.
- Chapter 3.1.1: Presentation of diurnal variation and time series of CO concentration is helpful because CO is a primary anthropogenic pollutant and follows the characteristics of a passive tracer owing to its long lifetime.
- Figure 2(b): What is the correlation coefficient between SV-OOA and LV-OOA-LRT? The time series look very similar. If the correlation coefficient is high, why is this so?
- What is the correlation coefficient between bb_{ff} and bb_{wb}? HOA-1 shows a stronger correlation with bb_{wb} than bb_{ff}, although the changes in HOA-1 show a close pattern with traffic changes. It looks like bb_{wb} does not represent biomass burning emission.
- Line 377: The evidence is fragile. There are no types of cars that suddenly operate only on Saturday night (or day).