

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-651

Anonymous Referee #3

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Referee comment on "Spatial variability of air pollutants in a megacity characterized by mobile measurements: Chemical homogeneity under haze conditions" by Reza Bashiri Khuzestani et al., Atmos. Chem. Phys. Discuss.,  
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The paper reported the on-road mobile measurement results in megacity in China. It is interesting that homogeneous and heterogeneous spatial distributions were observed respectively for haze and clean days. The fine spatial resolution measurement provided a lot of information on localized sources, which is potentially useful for the development of future pollution control strategies. Overall, the paper is well written and logically organized. High-spatial resolution measurements is important yet scarce in China. As one of the pioneering studies in China, I recommend the paper be published subject to minor revision.

Specific comments:

1. Line 85, both mass resolution and time resolution of the ToF-ACSM sampling should be provided.
2. Line 94 and Line 100, I don't think this is a good way to describe how the PMF results were derived and how the instruments were run during the campaign. Although experimental details had been published in the papers from the same group, readers may not have read the other ones and it is not their duty to do so. As an independent submission, at least all the necessary experimental details should be provided in SI to aid understanding of the whole manuscript.
3. Line 125: The authors run the mobile lab on the highway, which is largely affected by the on-road vehicle emissions. Although self-contamination from the exhaust of the mobile lab could be eliminated, I'm not sure whether the data could represent the characteristic the specific area as shown on each pie in Figure 1. In another word, if the mobile lab was run on the road several meters away from the highway, would similar composition distributions be derived?
4. Lines 125-145, it is interesting that on clean days great spatial variability of aerosol components was observed. What about the daily variation? I'm curious whether the observed spatial variation can well represent the local emission. Also, why the authors specifically present the results of the noon cycles instead of the average of the whole cycles for one day or during all clean days' sampling since the campaign lasted for around

2 weeks.

5. Line 164: megacity scale? Or the authors meant the regional scale?

6. Line 248: Why hydrocarbons accumulated in the afternoon (12:00pm-14:00pm)? Hydrocarbons should decrease during the noon time because of photochemical consumption as observed from on-site measurements in literature.

7. From the discussion in Section 3.3, it seems variations of VOCs and OVOCs species are predominantly driven by on-road vehicles or high-emitting plumes. The running cycles on the 4<sup>th</sup> Ring Road cover different regions characterized by different functions, such as industrial area, residential area, etc., yet the VOC characteristics in different regions were not discussed in detail except vehicle emission. Could more information on local sources for different regions be derived from the measurements? After all, mobile emission is not the only emission source.

8. Line 540: Legend, non-haze and haze days should be denoted in Figure 4.