

Atmos. Chem. Phys. Discuss., referee comment RC2  
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## Comment on acp-2021-293

Anonymous Referee #2

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Referee comment on "Characterization of ambient volatile organic compounds, source apportionment, and the ozone-NO<sub>x</sub>-VOC sensitivities in a heavily polluted megacity of central China: effect of sporting events and emission reductions" by Shijie Yu et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-293-RC2>, 2021

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The study by Shijie Yu et al. is a comprehensive assessment of the air quality over Zhengzhou before, during and after the 2019 National Minority Games, during which policy making decisions reduced the emission sources to investigate the implications on the local air quality. This is an excellent study for identifying and quantifying the impact of reduced anthropogenic sources. The paper is very written and it is particularly interesting that the authors have thoroughly analysed the data, providing PMF analysis, modelling, PSCF, O<sub>3</sub> formation potential and eventually health risk assessment. That said, there are a couple of critical points in the study that should be better clarified before publication.

### General comments

- It seems that the ozone formation potential remained unchanged compared to the control and post-event periods. The factors of 0.23 and 0.17 that were derived shall include the uncertainties before reaching a conclusion on whether the reduction of regional emissions had indeed an impact. Generally, the study fails to provide qualitative evidence on the significance of the emission reductions but this is explained by the complexity of regional (not only local) sources and meteorology. The study succeeds in reaching a clear conclusion (VOC:NO<sub>x</sub> ratio has to be reduced by a factor of 2) but on the other hand, ozone production is not an instantaneous process and the assessment does not include O<sub>3</sub> transport from other regions.
- From Figure 1, the most interesting period seems to be the week of 8-15/9/2019. However, the authors provide little no discussion on this period. In the same lines, the authors conclude that the city of Zhengzhou is within the VOC-limited but this period indicates the opposite: O<sub>3</sub> is strongly decreased together with the NO<sub>x</sub> concentrations while VOCs remain unchanged. A whole new sub-chapter discussing this week and investigating the respective processes is essential.
- The references are ca 80% from Asian authors. While indeed the study has been conducted in an Asian city, the chemical processes and source composition signatures are universal. Highlight papers from atmospheric chemistry have been ignored and replaced with regional references and therefore, the authors should try to increase their literature, including international studies. Some examples are mentioned in the specific

comments below but this comment applies to the complete text.

- The units (ppb and ug/cm<sup>3</sup>) should be homogenized.

#### Specific comments

L41. Please include the uncertainties on the values

L59. 'Some' VOCs

L104. Remove `,'

L269. Please elaborate further. If ozone precursors decreased significantly (I would argue that this significance is not illustrated by the results presented) then apparently, the ozone has been transported from other regions.

L312-314. It is not evident that this reduction is significant (Figures S5 and S6). Please include errorbars in Figure S5

L320-321. It seems that meteorological conditions and transport is more significant than the local emission reductions.

L330-332. Isoprene is indeed considered as an excellent biogenic tracer. However, anthropogenic isoprene sources may be also considered.

L335-336. In line with my general comment, TVOCs seem to remain unchanged and therefore, the conclusion is driven mainly by model studies.

L339. Biased reference selection on VOC oxidation.

L347-348. Halogenated compounds have increased lifetimes so claims on night-time chemistry are somehow unsuitable.

L350-353. I-n pentane is used for decades as an excellent tracer for source identification and there are dozens of widely cited studies to illustrate this. Please add more references.

L357-358. Please add more references.

L366. Biased reference selection.

L378. Figure S8. Seems that the benzene to toluene ratio splits in two clusters, further supporting the impression that the NMG period has two distinct chemical composition regimes that need to be further analysed and discussed.

L426-427. Isoprene emissions from vegetation should contain a reference from A. Guenther

L497-499. Biased reference selection.

L550. It would be interesting to see the ozone production lines in a second y-axis.