

## Comment on acp-2021-522

Anonymous Referee #1

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Referee comment on "Dramatic changes in Harbin aerosol during 2018–2020: the roles of open burning policy and secondary aerosol formation" by Yuan Cheng et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-522-RC1>, 2021

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The manuscript by Cheng et al. investigated the characteristics of haze pollution during two sequential heating seasons in the central city of the Harbin-Changchun (HC) metropolitan area, with a focus on the major drivers responsible for the observed inter-annual variations of aerosol composition. Compared to traditional hotspots of air pollution studies in China (e.g., the North China Plain), HC is unique with respect to both meteorological conditions (e.g., the extremely cold winter) and anthropogenic emissions (e.g., those from the intensive energy use for central and space heating). Therefore, observational results from this region may provide additional insights into haze pollution in China. However, PM<sub>2.5</sub> in HC remains largely unexplored with limit studies, which may explain the relatively slow improvement of air quality in HC compared to the North China Plain. In this context, the authors did a good job of unfolding the chemical compositions and sources of PM<sub>2.5</sub> in HC. Many in the community of atmospheric science would be interested in the results presented. My overall assessment is that this manuscript could be considered for publication in ACP given the following concerns (mostly technical) could be properly addressed.

- Line 54, suggest changing "aerosol" to "aerosols".
- Line 58, "its effects on SOA..." should be better.
- Line 97, suggest removing the "the" after "with"; in addition, references should be provided for "limited studies".
- Line 177, as indicated by the PMF source profiles, it seems that zero EC was apportioned into the two factors representing secondary aerosols. Please confirm and revised the description if necessary.
- Lines 207-208, I think the "during 2019-2020" here is redundant and unnecessary.
- Lines 227-228, rephrase "the same OC average concentrations".
- Line 235, references should be provided for the ISORROPIA model.
- Line 249, suggest adding a "usually" before "not".
- Line 261, suggest adding a "the" before "positive".
- Line 287, the meaning of "those" is not clear enough.
- Line 291, references are necessary for this statement.

- Line 307, suggest adding an "In addition" before "an obvious difference..."
- Line 318, suggest changing "emission" to "emissions".
- Line 332, please note that the more rapid decrease of SO<sub>2</sub> emissions compared to NO<sub>2</sub> is valid only for recent years in China.
- Line 637, change "contribution" to "contributions".
- Line 647, suggest adding an "an" before "ambient", and changing "with" into "at".
- Annotation in Figure 8, suggest changing "Stronger impact of..." to "Stronger impacts of..."
- Caption of Figure S4, suggest using "increasing strengths of biomass burning impact".
- Caption of Figure S6, I guess something was missing after "Relationship between OC/EC".
- Caption of Figure S7, rephrase the sentence "For the 2019-2020 campaign, (OC/EC)<sub>pri</sub> and OC\* were determined as the slope..."
- Captions of Figures S9 and S10, it is unnecessary to repeat the definition of "D" and "H" conditions.
- Caption of Figure S11, suggest changing "temperature" to "temperatures".