

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-268

Anonymous Referee #1

Referee comment on "Sources of organic aerosols in eastern China: a modeling study with high-resolution intermediate-volatility and semivolatile organic compound emissions" by Jingyu An et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2022-268-RC1>, 2022

General comments :

This paper develops a high-resolution emission inventory of IS-VOCs over China and simulates organics over the Yangtze River Delta (YRD) region using the CMAQ model. The influence of difference IS-VOC sources are investigated. The paper is well written and interesting as the influence of the different sources of organics are carefully studied. However, the novelties of this study should be better highlighted, probably by adding a section in the introduction about previous work on IS-VOC emissions in China and abroad. Also, this paper seems similar to the paper of Li et al. Environmental Pollution 2022 (see reference in specific comments below). How do the set up and findings compare to the paper of Li et al. (2022) ? I suppose the IS-VOC inventories are done differently, but this should be explained.

Specific comments :

Introduction

- L77 « SOA concentration is substantially lower than that measured in the atmosphere ». This is not always the case with the VBS method, and simulated SOA tends even to be too high, see Lane et al. (2008) for example.

Lane, T. E., Donahue, N. M., and Pandis, S. N.: Simulating secondary organic aerosol formation using the volatility basis-set approach in a chemical transport model, Atmos. Environ., 42, 7439–7451, <https://doi.org/10.1016/j.atmosenv.2008.06.026>, 2008.

- L78-81 Another shortcoming in the modelling of OA with the VBS 1D is the lack of representation of the hydrophilic properties of OA. VBS 1D assumes SOA condenses onto an organic phase, whereas SOA may also condense on an aqueous phase, see Kim et al (2011) for example

Kim Y., Couvidat F., Sartelet K. and Seigneur C. (2011), Comparison of different gas-phase mechanisms and aerosol modules for simulating particulate matter formation. *J. Air Waste Manage. Assoc.*, 61, 1218-1226, doi:10.1080/10473289.2011.603999.

- L88 : please define IVOC, SVOC. How are they quantify ? Which range of volatility ?
- L128 : « I/SVOC emission profiles have not been taken into account in previous studies. » This is not correct, they do have been taken into account in numerous studies. See the review of Ling et al. (2022) and other papers below.

Zhenhao Ling, Liqing Wu, Yonghong Wang, Min Shao, Xuemei Wang, Weiwen Huang, Roles of semivolatile and intermediate-volatility organic compounds in secondary organic aerosol formation and its implication: A review, *Journal of Environmental Sciences*, Volume 114, 2022, Pages 259-285, <https://doi.org/10.1016/j.jes.2021.08.055>.

Over the States : Jathar, S. H., Woody, M., Pye, H. O. T., Baker, K. R., and Robinson, A. L.: Chemical transport model simulations of organic aerosol in southern California: model evaluation and gasoline and diesel source contributions, *Atmos. Chem. Phys.*, 17, 4305–4318, <https://doi.org/10.5194/acp-17-4305-2017>, 2017.

Over Europe : K. Sartelet, S. Zhu, S. Moukhtar, M. André, J.M. André, V. Gros, O. Favez, A. Brasseur, M. Redaelli, Emission of intermediate, semi and low volatile organic compounds from traffic and their impact on secondary organic aerosol concentrations over Greater Paris, *Atmospheric Environment*, Volume 180, 2018, Pages 126-137, <https://doi.org/10.1016/j.atmosenv.2018.02.031>.

Over China : Jie Li, Zhiwei Han, Jian Wu, Jun Tao, Jiawei Li, Yele Sun, Lin Liang, Mingjie Liang, Qin'geng Wang, Secondary organic aerosol formation and source contributions over east China in summertime, *Environmental Pollution*, Volume 306, 2022, 119383, <https://doi.org/10.1016/j.envpol.2022.119383>.

Materials and methods

The authors state that they establish a new IS-VOC emission inventory. However, there is only little detail about it. More details would be welcomed.

L153-165 : it is mentioned that the gas-phase IS-VOCs are obtained from ratios of IS-VOCs to VOCs and particle phase IS-VOCs are obtained from ratios of IS-VOCs to POA). Then IS-VOCs are distributed into volatility bins. The ratios are detailed in the supplementary material S1 (which should be referred to in the paper, but is not in the current version). How are the ratio defined ? Only a few references are given in Supp S1. Please add a reference for each activity sector. How are the distributions into volatility bins defined ?

By setting up differently the IS-VOCs in the gas phase and the IS-VOCs in the particle phase, how can we ensure that the gas and particle phases are consistent ?

Results and discussion

L293-296. The estimation of IS-VOC in the gas phase computed in this study is compared to what was found in other studies. However, there is not much details and it is hard to understand what differs between the studies. A section should be added to detail what was done in previous emission inventory of IS-VOC in China and abroad. This should be probably added in the introduction. I guess that the factors used to estimate IS-VOC are different in this study than in other studies over China, because IS-VOC are estimated from AVOCs. This should be clearly stated in the introduction. Also, note that IS-VOCs have been estimated from AVOCs in other previous studies over US and Europe.

L352. Please summarize the method of Lu et al. (2020) in a few sentences.

L449. Is there an increase of AVSOA in IMPROVE compared to BASE ? It is surprising if there isn't, as organic concentrations are higher in the IMPROVE simulation, leading to higher absorbing mass.

L451. What was expected ?

Conclusions

L655. « SOA increased by 1.2 times in IMPROVE simulation ». However, I 431 stated that OA are 38% higher in IMPROVE simulation. Why are these numbers different ?