Comment on egusphere-2022-895
Anonymous Referee #1

Referee comment on "The underappreciated impact of emission source profiles on the simulation of PM$_{2.5}$ components: New evidence from sensitivity analysis" by Zhongwei Luo et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-895-RC1, 2022

The manuscript attempts to explore the influence of adopted emission source profiles in CTMs on the simulated results of PM$_{2.5}$ components by sensitivity analysis. The extent of the influence for different components were quantitatively analyzed, the impact laws and pathway were identified. The topic is interesting and their findings highlight the importance of effective utilization of emission source profiles in CTMs. Although the description of experiments is complete to allow their reproduction by fellow researchers, some explanations and discussions are not clear. I recommend its publication subject to the following amendments.

Major concerns:

- What is the design basis for the perturbation of emission source profile in the sensitivity experiments?
- The discussion of the results should be extended. The authors mentioned that emission source profile adopted in CTMs has a significant impact on the simulation results of PM$_5$ components, so how to select the appropriate source profiles in the simulation? In the section of conclusion (Line 549-551), the author concluded that “the representativeness and timeliness of the source profile should be considered”. How to understand the “representativeness” and “timeliness” here?

Minor concerns:

- Line 21 and Line 27, there are two notes for CTM in one paragraph, which appear to be repetitive.
- Line 57-59, the references are verbose.
- Line 111-113, It is not clearly explained the role of source profiles in CTMs.
- Line 257: “The detailed information on” should be “The information of...”
- Line 259: “Coefficient Divergence (CD)” would be appropriate
- In the supplementary material, Fig. S1, the author selected code 91041, 900162.5, 91155, 91022 and 91162 as SPECIATE source profiles for simulation. Detailed information of these source profiles need be provided by authors.