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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sensitivity of organic aerosol simulation scheme on biogenic organic aerosol concentrations in climate projections" *by* Arineh Cholakian et al.

Anonymous Referee #3

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In this work, Cholakian et al. used three different organic aerosol simulation schemes in order to identify how they impact the calculated OA load on future climate projections. They found significant differences on the calculated biogenic SOA projections over Europe between the three OA schemes; highlighting the uncertainties that still exist on OA calculations. This study is of definite interest to the organic aerosol modeling community by contributing towards the understanding of the source of uncertainty between OA schemes (e.g., highlighting the role of temperature sensitivity). Overall, the manuscript is very well written and the presentation is clear. Therefore, I recommend this study for publication. Below are a few minor comments to be considered prior to publication.

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Discussion paper

Specific comments:

1. Title: I believe the manuscript focuses a lot on biogenic SOA, therefore is better to replace the general term “particulate matter” with biogenic SOA. Furthermore, the manuscript presents the sensitivity of BSOA concentrations on the OA scheme used and not vice versa as the title implies. I suggest to consider revising the title.

2. Page 1 lines 7-8: the word “formation” is unnecessarily repeated two times in the sentence

3. Page 1 lines 7-8: This sentence is not clear. I assume you men the temperature differences.

4. Page 2 line 1: Tsimpidi et al. (2017, doi: 10.5194/acp-17-7345-2017) is also a nice recent study that emphasizes the large uncertainty of OA formation.

5. Page 2 line 3: Lelieveld et al. (2015, doi:10.1038/nature15371) also highlight the adverse effects of OA on human health due to their increased toxicity.

6. Page 2 lines 22-25: The scheme of Pankow (1994, doi: 10.1016/1352-2310(94)90093-0) should be included in the discussion here

7. Page 4 1st pargraph: More information is needed for the simulations conducted by the global models and WRF (e.g., which RCPs were used, which is the suimulation period, etc. ?) Furthermore, are all the links between the models offline?

8. Page 5 lines 18-21: It has been also shown that the aging of BSOA does not lead to any net changes on its mass concentration due to a balancing effect between fragmentation and functionalization (Murphy et al., 2012, doi: 10.5194/acp-12-10797-2012)

9. Page 5 lines 22: Actually, the standard VBS scheme assumes that fragmentation and functionalization processes result in a net average decrease in volatility for SOA. Therefore, even if it does not simulate explicitly the fragmentation process, it has taken

into account its effects on the SOA volatility changes.

10. Page 5 lines 27: Can you briefly discuss the main differences between the standard and the modified VBS schemes (e.g., aging rate constants, changes on volatility and oxygen atoms added after each reaction step, etc.?)

11. Page 7 lines 22: Can you comment on why all schemes significantly fail to reproduce the observed OA concentrations during winter?

12. Page 8 lines 11: Add “the” before “average”. Furthermore, the emission units do not seem correct. You need “amount time-1 area-1”. It would be better to report the emissions in Tg/yr for the whole domain.

13. Page 9, Figure 4: The figure caption states that these are BSOA but the figure legend has SOA (i.e., SOA2p, SOAvbs, SOAmod)

14. Page 9 lines 6-9: I found this sentence long and confusing

15.Page 10 lines 12: use capital A for August

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