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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Analysis of Secondary Organic Aerosol Simulation Bias in the Community Earth System Model (CESM2.1)" *by* Yaman Liu et al.

Anonymous Referee #1

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General comments

This is an interesting and well written paper. They study evaluates organic aerosol in CESM2.1 over the United States by comparing the model to long term surface measurements and aircraft campaigns. The authors find that the model overestimate organic aerosol during summer. Moreover, the model comparison with flight campaigns reveal that the model underestimate organic aerosol in the upper air. The authors conclude that these results could be explained by too high monoterpene SOA yields which result in too strong SOA production close to monoterpene sources.
The topic of this paper falls well in the scope of ACP. The scientific methods in the paper are sound and well explained. The authors explain and discuss the results in

the figures and tables in an clear and interesting manner. I recommend the paper for publication in ACP after the following comments have been addressed.

Specific comments

- The model used in this study, CAM6-Chem differs from the standard CAM6 since it has a more advanced chemistry. My impression is that CAM6 is the standard atmospheric model in CESM2.1. Could you describe to what extent CAM6-Chem is used in comparison to CAM6? It would be beneficial to better clarify the differences between CAM6 and CAM6-Chem in the methods section. In part of the method you describe the changes in CESM2.1. It would be nice to refer to CAM6 or CAM6-Chem instead, as the text is currently written it is difficult to know if the VBS scheme is included in both CAM6 and CAM6-Chem or only in the latter.
  Moreover, you have evaluated CAM6-Chem, but it would be interesting to know how well CAM6 performs in comparison to CAM6-Chem with respect to organic aerosol. What is the the differences in performance between CAM6-Chem and CAM6 in terms of organic aerosol?
- The model is only compared to observations over the United States. Could you comment on the limitations of this and if the model has been evaluated in other locations in any other studies.

Technical corrections

- Line 771,:"over previous versions" sounds a bit odd.
- Line 138-141: This is a very long sentence, please split it up.
- Line 169: "prominently overestimates in" is there a word missing here? What is overestimated?

- Line 170: "with a strong correlation with observations of 0.60 as shown in Fig. 2c" The correlation coefficients are not shown in Fig 2 but rather in Table 3. Please refer to the table or both the figure and table. The same problem with referring to figure 2 instead of table 3 occur on line 174.
- Line 170: "As compared with CONUS domain, simulation at" are there missing words in this part of the sentence?
- Line 295-299. This is a very long sentence that should probably be split up. Also, the English in this sentence needs to be checked.

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