Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Modelling organic aerosol concentrations and properties during ChArMEx summer campaigns of 2012 and 2013 in the western Mediterranean region" *by* Mounir Chrit et al.

Anonymous Referee #3

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Chrit et al. have performed simulations using an air quality model and compared predictions of organic aerosol mass and composition to measurements at a remote site in the Mediterranean Sea. They found that model updates based on the inclusion of new secondary organic aerosol formation pathways improved the model-measurement comparison. Overall the manuscript is well motivated, researched, and discussed. I recommend publication after the authors have had an opportunity to respond to my comments and considered my suggestions.

1. Page 1, line 5: Consider using the noun form: hydrophilicity.

2. Page 1, line 15: 'percent' not 'percents'.

3. Page 2, lines 1-10: References are dated. Consider newer references.

4. Page 2, lines 8-9: Rephrase.

5. Page 2, lines 13: Intermediate-volatility organic compounds are a separate precursor category. Add discussion in the introduction.

6. Page 2, lines 16-22: It would be helpful to be more quantitative when citing earlier work. For example, what fraction of the organic aerosol that El Haddad et al. (2011, 2013) measured was biogenic in nature?

7. Page 2, lines 17-19: Hayes et al. (2013, 2015) argue that the biogenic SOA found in Los Angeles was produced near the source and then transported into the city. Suggest citing and reconciling with Hayes work.

8. Page 2, line 20, Page 9, line23 (and elsewhere too): 'Fossil' and not 'fossile'.

9. Page 2, line 19: Was Minguillon a measurement or modeling study?

10. Page 3, line 16: Incomplete sentence: 'monoterpenes oxidation products SOA over the U.S.'.

11. Page 4, Section 2.1: Can you briefly summarize the existing SOA precursors, species, and processes in the model and discuss how those earlier processes do not overlap with the updates made in this work?

12. Page 5, line 26-28: Am I correct that these oxygenated peroxy radicals can be formed only in the absence of NO? If yes, specify.

13. How is gas/particle partitioning of the explicit oxidation products modeled? If only briefly, please summarize the partitioning model and assumptions.

14. Page 8, line 2: I did not understand the meaning of 'nested rep.' in parentheses.

15. Page 8, line 14: 'split' not 'splitted'.

16. Page 8, line 18-20: The SVOC/POA ratios might be a little too high. See work of May et al. (2014a,b) for estimates on SVOC/POA ratios. Also, is there a reason why IVOC emissions were not considered? See work of Jathar et al. (2014) and Zhao et al. (2015, 2106) for estimates of IVOCs from combustion sources as a function of VOC emissions.

17. Page 8, lines 25-28: What is the organic fraction in sea salt emissions?

18. Page 10: How does the model perform in predicting the diurnal variations in OA?

19. Figure 2: The composition in Figure 3 tells me that the model updates must also have increased mass concentrations and resulted in better comparison in Figure 2. This fact is missing in Section 4.1. Please state the importance of this either in Section 4.1 or in the conclusions in Section 6.

20. Section 4.2: Has the model been evaluated for other pollutants? For example, black carbon, carbon monoxide, ozone, NO.

21. Page 11, line 20: How low are the sesquiterpene emissions compared to isoprene and monoterpenes? Be quantitative.

22. Page 11, line 22: IVOCs are mentioned here but are they actually included since the methods do not talk about them.

23. Figure 3 and 6, left panel: Why is the pie not a circle? Also, consider increasing the font size for readability.

24. Page 12, line 5: 'There are a variety. . .'.

25. Page 12, line 7: 'ponderating'?

26. Figure 4: The legend makes it seem like the model predictions systematically discount (or subtract) the effects of the three updates rather than the opposite that is mentioned in the caption. Replace '-' with '+'?

27. Figure 4: Given that the OM:OC and O:C measurements are not directly measured but rather interpreted from the ACSM data, can the measurements be shown with error bars?

28. Page 14, lines 5-7: Can the authors describe the mechanism at play here and the correct citation?

29. Section 4.4 and Page 1, line 11: The claims about improving the hydrophilicity predictions are slightly misleading since what the authors have actually done is improve predictions of mass concentrations of water soluble organic carbon.

30. Figure 6 does not have a left-right panel but a top-bottom panel. Fix caption.

31. Figures 7, 8 and 9 could be combined into a single multi-panel figure. Also, consider adding city names to orient the reader not familiar with that part of the world.

32. Sensitivity analysis: How sensitive are the model predictions and the findings from this work to the various inputs (reaction rate constants, yields, etc.) listed in the appendix? I would encourage the authors to perform additional simulations to (i) develop lower and upper bounds on their estimates for ELVOCs, organic nitrates, and MBTCA and (ii) develop insight on the most important inputs that would guide future laboratory work.