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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulation of fine organic aerosols in the western Mediterranean area during the ChArMEx 2013 summer campaign" *by* Arineh Cholakian et al.

Anonymous Referee #2

Received and published: 21 November 2017

This paper describes efforts to simulate atmospheric meteorology, gas-phase species, and particle-phase species during the ChArMEx 2013 campaign. Surface meteorology data are derived from a site on Corsica and a site on Mallorca. More elevated meteorology data are derived from soundings on the continent. Gas-phase and particle-phase data are derived from the surface sites on Corsica and Mallorca. The orographic nature of the Corsica site caused an additional complexity within the model. The modeling effort uses four different techniques to simulate organic aerosol loadings, and that which best matches observations (at the two surface sites) is used to apportion the organic aerosol to primary material (assumed predominantly to be anthropogenic) and biogenic/anthropogenic secondary material. At these locations, biogenic secondary or-

ganic aerosol seems to dominate, at least during the period of observation/simulation. This is not a surprising result based on previous simulations in Europe.

While I recognize the importance of being able to simulate secondary organic aerosol, this paper seems more like a method development paper in that it extensively compares the results from the four SOA techniques. However, these types of evaluations were done during development of those models. As a result of these efforts, the authors recommend the updated VBS approach which takes into account fragmentation, as well as formation of non-volatile material. This is not surprising given the documented issues with the more simple CHIMERE standard approach and the VBS with the biogenic aging. In addition, the model does not include any cloud processing, despite the fact that the observations indicate that such a phenomenon is likely to occur.

In addition, the authors do not give appropriate credit of the work of Chrit et al. (2017) who simulated this same data, using a different approach. The authors indicate that the concentrations and properties are well simulated – so this calls into question the need for the current paper. What does this new study tell us that the work of Chrit et al. (2017) did not?

As a result of these facts, I do not find this manuscript very novel, and I am unable to recommend publication. However, if the authors wish to completely refocus the manuscript, they must address the issues below, in addition to the novelty issues. The authors should consider also simulation of other time periods (as suggested in Page 19, Line 28, the last paragraph).

The paper also could use some editing for writing. There are several instances where verbs are missing and where coordinating conjunctions are missing (particularly when the word therefore is used). There are also some word choice issues (sanitary, transportation), and it should be noted that the word 'data' is plural so that verb agreement needs to be corrected. There are also instances where paragraphs only have one sentence.

Other specific comments Section 2 Page 4, Line 8. The wording here makes it seem like Europe is a country.

Page 4, Line 13. I did not find Table 1 particularly useful. It could be incorporated into the Figure 1 caption.

Page 4, Line 33. What is a shipping snap sector?

Page 5, Line 10. Has MELCHIOR been updated since its inception in 2003?

Page 5, Line 13. What is the distribution of particle sizes in the model? That is, the authors provide the range but not any information about how the bins are spaced.

Page 5, Line 24. Pun and Seigneur were not the source of the experimental data. This citation should be to the original manuscripts.

Page 6, Line 27. Please provide more detail on how this ratio of NO reaction rates is used to determine the low versus high NOx yields. What values of this ratio correspond to low versus high NOx? What are the bounds of this ratio?

Section 3 Page 7, Line 19. Was only total NOx measured and compared? Were there any issues due to conversion of other NOy species into NO?

Page 8, Lines 2 and 5. I do not understand why a constant value of HOA was assumed for each PMF. This needs to be clarified as model results are later compared to these values.

Section 4 Page 9, Line 6. The wording here should be changed to indicate that it is the simulated height of the cell in which the site was located was underpredicted – not that the simulated height of the site was underpredicted (since the authors are not actually simulating the height of the site).

Page 9, Line 27. Higher than a fixed value? What value? What was its basis?

Page 9, Line 39. The authors state that secondary species appear less influenced by

the orographic uncertainty. However, the impact on MVK + MACR is as large as that for primary species. The authors need to be careful with their word choice.

Page 10, Line 35. I do not believe that this last sentence is necessary.

Page 11, Line 7. The caption from Table 4 needs to refer to Figure 5.

Page 11, Line 32. Does this requirement of a regional look at the aerosol call into question the use of two sites?

Page 12, Line 19. Here is evidence for cloud processing (again, it is presented for BC later). However, no mention of cloud processing in the aerosol modules is mentioned. Why not link the updated VBS with a cloud processing module? That would certainly enhance the novelty of the work.

Page 13, Line 3. I do not find this summary paragraph necessary.

Page 13, Line 27. Figure 7 caption has an error in the word standard.

Page 13, Lines 30 and 31. Please provide standard deviations on the averages.

Page 14, Line 12. What is meant by 'respected'?

Page 14, Line 34. I do not see much use for Table 7. This text can be included in the main body of the manuscript.

Page 15 and beyond, The colors in Figures 8, 9, and 11 need to be differentiated to a greater extent if they are included in any future submission.

Page 17, Line 15. I find this summary paragraph unnecessary.

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