Atmos. Chem. Phys. Discuss., 13, C2442–C2446, 2013
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Atmospheric Chemistry and Physics Discussions

Interactive comment on "VOC emissions, evolutions and contributions to SOA formation at a receptor site in Eastern China" *by* B. Yuan et al.

Anonymous Referee #3

Received and published: 16 May 2013

This study investigated VOC emissions and their contributions to SOA formation in Eastern China. It is found that the emission ratios of OVOCs are significantly lower than those from the emission inventory. Based on the measured VOCs, it is found that the modeled SOA is much lower than measured and the authors suggested that part of the missing SOA could be from the oxidation of SVOCs.

While the paper is generally well-written, I think many parts of the manuscript require further clarification (please refer to specific comments below). The authors employed equations from de Gouw et al (2005). However, it is not clear if these equations can be applied to the Changdao data in the first place; the authors did not discuss the assumptions nor justify them in the manuscript. It is extremely important that the authors discuss these in details as they derived many of their conclusions based on results

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from these calculations. Further, the authors compared their results to a few other cities/locations (e.g., Beijing, Tokyo, Mexico City, NE US) and discussed the differences/similarities. However, they did not provide much context regarding why they chose to compare their results to these locations. (For example, do they expect the VOC emissions, photochemical processes, etc, to be similar in Changdao and these cities?) Hence, it is difficult to comprehend what conclusions they were trying to draw from such comparisons. Finally, the authors attempt to use the results from Changdao to infer SOA formation from anthropogenic emissions in China in the conclusions section. This section is weak and over-stretching without a detailed discussion on why the results from Changdao are representative of China as a whole.

Overall, I think revision is needed to incorporate more detailed discussions and justifications of their methods/conclusions before the manuscript can be published in ACP.

Specific comments:

1. Page 6632, lines 19-22. I do not understand this sentence. The authors are comparing SOA formation from China in general to the measured SOA in Beijing and PRD?

2. Page 6635, line 1. Why is this site a receptor site? Please explain further.

3. Page 6635, line 18. The authors stated that the introduction of internal standards led to interference from sampling lines or the canister. How does the interference affect their results? Are the results corrected for such interference? Please clarify.

4. Page 6636, lines 29-30. Where are the T, RH, wind speed and direction measured exactly? If they are not measured exactly at the site or close to the site, how can the authors be sure that the data from the Bureau of Meteorology are representative of their site?

5. Page 6637, lines 19-20. The authors wrote “The fractions of three main classes in the hydrocarbons are consistent with the results obtained at the suburban and rural sites around Beijing”. What is the basis of this statement? Do the authors expect

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the composition of hydrocarbons to be similar between Changdao and rural/suburban Beijing?

6. Page 6639, lines 14-15. How is the uncertainty in NO3 concentration estimated? Please explain clearly.

7. Page 6640. It is surprising that the reaction with NO3 is the dominant loss mechanism for isoprene and monoterpenes. The authors need to show the diurnal profiles of the calculated [OH] and [NO3], as well as that of isoprene and monoterpene to explain and justify this in more details.

8. Page 6641, lines 1-5. What are the assumptions and why and how they general hold true for the Changdao data? Here and in many parts of the manuscript the authors used equations from de Gouw et al (2005) without much discussions. It is not clear how they can justify that the equations in de Gouw et al are applicable to the Changdao data. The authors need to provide more justifications.

9. Page 6641, line 9. Why m-xylene and p-xylene are lumped together? Is this because they cannot separate these two compounds in their measurements? If so, can they choose another species to calculate the photochemical age?

10. Page 6641, lines 14-15. I do not understand what the authors mean by "these two terms. . ..usually show up in pairs in the equation." Please explain more clearly.

11. Page 6642, line 11. Please elaborate on the "traditional correlation method" and point out the main differences between this method and the parametrization method.

12. Page 6643, line 11. Why unrealistic results are obtained from the fits if biogenic sources are included in Equation 7? What's the physical reason behind?

13. Page 6643, line 15. What do the authors mean by "calculated" OVOC concentrations? Did they fit the data and obtain values for the unknowns, then plug these values back to Equation 7 to get [OVOC]?

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14. Page 6644. Why did the authors choose to compare results from Changdao to these other sites? Do the authors expect something in common (sources? Photochemical processes? Etc) between Changdao and these cities?

15. Page 6647. Why are the values so unstable for an aerosol lifetime between 1-3 days?

16. Page 6651, glyoxal discussion. Do the authors have any evidence that the aerosols in Changdao are aqueous (or, have enough water) for glyoxal uptake? Can they infer this from their RH data? The authors stated that "Glyoxal could be a significant source of SOA formation. . .." But then later stated that "it should not be enough to explain the large discrepancies between measured and calculated SOA." Without glyoxal measurements, how did the authors decide whether it is "enough" or not?

17. Page 6653. I do not understand Equation 14. According to line 11, delMoi is the SOA formed from SVOC species i. But, SOAi is also the SOA formed from SVOC species i?

18. Page 6656, lines 4-21. Do the authors expect the Changdao data to be representative of all China? If not, this paragraph does not seem convincing and it appears that the authors are stating more than what they can conclude from their data.

19. Page 6667. What are the monoterpene concentrations?

20. Page 6667. How are the uncertainties determined for each species?

21. Page 6670. Are low NOx data also calculated with Mo=15 and T=10?

22. Page 6671. Where do the VOC emissions data (color legend) come from?

23. Page 6673. What is the shaded region? 30% uncertainty?

Technical comments:

1. Page 6632, line 22. "This" should be "these".

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2. Page 6637, line 14. “significant” should be “significantly”.

3. Page 6642, line 14. Delete “but”.

4. Page 6646, line 13. “Poor-known” should be “poorly-known”.

5. Page 6649, line 28. Delete “Thus”.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 6631, 2013.

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