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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Biogenic VOC oxidation and organic aerosol formation in an urban nocturnal boundary layer: aircraft vertical profiles in Houston, TX" *by* S. S. Brown et al.

Anonymous Referee #2

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This paper investigates how nighttime oxidation of biogenic hydrocarbons contributes to organic aerosol loading. For their analysis the authors used vertically resolved aircraft data from low approaches to airfields in Houston, TX, reporting vertical profiles of NO3, N2O5, NO, NO2, O3, speciated VOCs, aerosol composition and aerosol size distributions, along with profiles of potential temperature. Box model simulations are used to estimate the magnitude of organic aerosol production. The authors conclude that organic aerosol is indeed efficiently formed within the nocturnal boundary layer, as a result of the oxidation of biogenic VOCs by nitrate radicals.

The paper provides new insights into chemical transformations during the nighttime,

which take place in a stratified boundary layer. Vertically resolved measurements of chemical species are comparatively rare, hence this paper is a particularly valuable contribution. The topics of secondary organic aerosol formation and anthropogenic/biogenic interaction fit well within the scope of ACP, and I recommend this paper for publication after the comments below are taken into account. I believe that these fall into the category "minor revisions".

General comment: While the analysis of the various flights is very thorough, it is easy for the reader to get lost in the details. It would be useful to add an additional paragraph that summarizes the take-home messages from the analyses of the three flights, highlighting differences and commonalities between them, and (for modelers) highlight which general features models should strive for replicating. It would also strengthen the paper to put the findings from this work into perspective with findings from previous studies.

Specific comments: 1. page 11870, line 18: The text and Table 1 mention that there were four nighttime flights, but the first one (Sep 29) is never discussed any further. Please state briefly the rationale for this choice.

2. None of the graphs show error bars. If these make the plots too cluttered, it would be helpful to add some information on uncertainty in the text. This is especially important when discussing the differences in k(NO3) and 1/tau(NO3) (e.g. Fig. 6, p. 11877, line 1). Given the uncertainties of the quantities that enter the calculation to derive these parameters, are these differences significant?

3. Page 11872, line 20: When describing the potential temperature profile, the term "discontinuities" is used. I suggest rephrasing this to "the gradient of the profile changed" or something along those lines, since the profile is certainly not discontinuous. This term is used a few times in the paper.

4. Page 11874, line 25: The discussion of Fig. 4c is unclear. ("... parameterizations for primary organic carbon emissions...") The figure doesn't show any emissions, please

reword this.

5. The sequence of graphs is different for the three cases, for example case 1 does not have a figure that corresponds to figure 6. This makes the analysis somewhat unsystematic. Is there a particular reason for this choice?

6. While section 3 discusses three flights, from section 4 on only two flights are presented. What is the rationale of this choice?

7. Box model simulations: If a detailed description of the model of which reactions are included and what method is used to solve the equations etc. is available in another publication, please cite this here. If there is no such reference, I suggest including a table that lists the reactions that are included in this box model and a short description on numerical methods.

8. Page 11888, line 17: "other simulation parameters are similar". Please be more specific here, are they the same, or are they different? If they are different, please specify.

9. Figure 17 and corresponding text: Why was the emission rate for this model run not consistent with the observed temperature? It seems like this would be a straightforward choice of parameter choice.

10. Figure 17 and 18: How exactly is the blue shaded area obtained?

Technical comments: 1. Page 11872, line 11: remove first “within”

2. Labeling of subfigures is in capital letters but in the text they are referred to with lower-case letters. This should be made consistent.

3. Page 11872, line 21: at the very end of this line, add “being”.

4. Page 11873, line 21: reference to Table 1 is wrong.

5. Page 11874, line 5: “enhanced nitrate”, suggest to change this to “enhanced nitrate

concentration”

6. Page 11882, line 8: remove second “in”

7. Table 2: notation for k(NO3) and k(O3) is inconsistent in caption and in table header.

8. Figure 8b: typo in legend for red line.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 11863, 2013.