

Interactive comment on “Comparison of the chemical evolution and characteristics of 495 biomass burning plumes intercepted by the NASA DC-8 aircraft during the ARCTAS/CARB-2008 field campaign” by A. Hecobian et al.

Anonymous Referee #1

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This paper investigates the composition of biomass burning plumes measured during the NASA ARCTAS-2008 experiment. Almost 500 plumes were identified and their compositions analysed. This must have been an enormous amount of work.

Despite the enormous amount of work that must have gone into this I found the paper, in the end, rather unsatisfying. The “vision” of what the paper is for should be strengthened. At the moment it feels like it has been forced into being because it was felt that a paper should be written rather than because the authors feel they have something specific to say. I think the major themes of the paper are to investigate 1)

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changes in concentration with time within plumes and 2) changes in concentration between plumes. The conclusions appear to be that there is little systematic change in the concentration with time within a plume and that there are significant difference in concentrations between plumes. I feel that authors should try and work their analysis to these conclusions and then state them more strongly.

I feel that the box modelling should be removed from the paper. I don't think that this offers anything new and I find the explanation of what was actually done for the modelling incomplete, and confusing. Not enough detail is provided here to evaluate whether the methodology is suitable. Are the authors considering this to be a semi-lagrangian experiment with the same plume being intercepted at multiple time down-wind? The transport model analysis is then used to convert the actual time the observations were made into a time since emissions? Where observations are available the model is constrained to those and when they are not available the model is allowed to calculate its own concentrations? This is really not explained at all well explained. The large jumps in the concentration of HO₂ and the tendencies of O₃ and PAN must be due to large changes in the concentrations of compounds or is it changing temperatures? It is not obvious to me what the model is doing? I don't think the conclusions here are particularly novel thus my suggestion is that this is removed and the emphasis placed on the data analysis.

Overall I feel that the paper be subject to major corrections and re-reviewed once this has been achieved.

Abstract The last sentence is very weak. When the plumes were compared what was the result?

Introduction At the end of the introduction I think the authors should put a section to explain the rest of the paper. I've become quite confused as to the “vision” for the paper but as I see it the analysis is split in two, with the first section looking at the processing within the plumes and the second section looking at the difference between plumes.

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This is not clear in the abstract or in the body of the paper.

Section 2.2.1 (Page 18598) Could typical examples or the complete set of trajectories be given here for each of the classification types?

Section 2.2.2 (Page 18599) Two methods are discussed for determining the ratio in the plume of [X] to [CO]. The authors should provide an example here of the two methods. Do the conclusions change if just use one of the methods is used? Which method was used for which species or does it change on a plume by plume basis? It would be worth using one method and seeing how this changes the conclusions

Section 3.2 The use of ANOVA in evaluating whether there are significant difference is good. Could a similar approach be used in previous sections? Are the concentration changes seen within a single plume statistically significant? One of the issues here is that most ANOVA approaches assume a normal distribution of the population. It is probably unlikely that this is the case here. Are the same conclusions reached if the ANOVA is performed on log concentrations as well as concentration. It would be good to give the some indication of the statistical difference (F value or p value) for each comparison. Are there some species for which the statistical differences are larger than for other? The statistical description for different compounds (concentrations, standard deviations etc) in the different plumes should be given as in a table so that they readily interpreted by other groups looking at other plumes.

Conclusions Again I found this section weak. The final paragraph covers a lot of work but really doesn't tell us very much.

Minor Comments Why are the OH team not included in the authorship? This seems a little odd. The word level should be replaced by concentration or mixing ratio.

Page 18698 How was the 40% value reached for the uncertainties? This is not well explained and seems rather arbitrary.

Page 18601. Processes in the plume other than dry or wet deposition can lead to

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changed. Chemical processing, uptake onto aerosol might make a difference here as well.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 18589, 2011.

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