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Interactive comment on “What do correlations tell us about anthropogenic–biogenic interactions and SOA formation in the Sacramento Plume during CARES?” by L. Kleinman et al.

Anonymous Referee #1

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This paper goes through a detailed correlation and regression analysis to assess if possible synergism can be found in OA formation from mixtures of anthropogenic and biogenic emissions (i.e., A-B enhancement). The analyses are based on a unique aircraft data set collected during the DOE CARES field study. A similar, but less in-depth, analysis has already been published with the same data set in other papers. This paper is unique in that it attempts a more rigorous approach.

The paper is well written and for the most part very clear. However, after reading through it there was no clear answer given to the objective of the analyses. What is the finding regarding the fundamental question the paper seeks to answer, is there

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evidence for A-B enhancement in this data set, yes, no, maybe, and with what uncertainty? This should be added to the Abstract, Conclusions, etc. A clear statement on this is desperately needed.

In the background the authors may wish to explain or discuss an observation sometimes used to support A-B enhancement, that is much higher OA in isoprene dominated but anthropogenic influenced SE compared to pristine isoprene dominated Amazon, eg, Poschl et al. (2010). How is this related to the findings of this paper (ie, maybe the authors can say, it is just the linear combination of A and B SOA in the SE US).

Regarding the discussion: The idea that more volume provided by the upwind biogenic OA may lead to enhanced anthrop. SOA assumes the process is all gas-particle partitioning to dry particles. One needs to consider the wet size at ambient RH (ie hygroscopicity, which is a function of composition), and if even more sophistication is desired, the possibility of aqSOA.

The last line of the discussion, referring to CalNex results, do not seem to apply to this work. In that case there was little biogenic VOC (in a relative sense to anthropogenic VOCs) impacting SOA formation in that environment. Is the point that in CalNex there was not biogenic/anthrop interaction? This discussion could be clarified.

Typo pg 25397 line 10. ... simultaneously a have high ...

Conclusion #5, did Zotter really find that most the OA in LA was non-fossil based on 14C analyses? I believe this statement is incorrect.

Conclusion #7, what is the conclusion, ie, is it that one cannot say, based on the unusual event, if or if not there was an A-B enhancement. Clarify.

Fundamentally, as noted in the last line of the paper, it all comes down to a correlation analysis, which cannot prove causation. Running a high resolution chemical transport model, as suggested, will not resolve the problem as the mechanisms of SOA formation are too poorly constrained. Have the authors thought of trying to do the same

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regression analyses on a better know process, O₃ chemistry, as way to “calibrate” the approach. That is, one might expect an O₃ enhancement due to biogenic VOCs and NO_x mixing within and downwind of the urban environment. Modeling would also be more informative for this chemistry.

Finally, the findings of Xu et al., PNAS 2015 are discussed, but not tested in this study. That is, was there any evidence for a similar isoprene SOA dependence on sulfate aerosol in this data?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 25381, 2015.

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