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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Investigating the links between ozone and organic aerosol chemistry in a biomass burning plume from a prescribed fire in California chaparral" *by* M. J. Alvarado et al.

Anonymous Referee #1

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This paper presents a plume modeling study of a single fire that took place in California in 2009. The study attempts to demonstrate the best fit parameterizations for unidentified VOCs in the fire plume. The paper is rather long (19 figures + tables) and complex. In places, there appears to be some significant missing information and the structure, in my opinion, needs some significant reworking. All of this said, I think the paper contains some important scientific conclusions and given significant editing could be suitable for publication.

But first, scientifically, I think the paper needs a better framing and context. The paper attempts to quantitatively model several gases including O3, PAN, etc and the

OA/CO2 enhancement ratio in the fire plume using several possible parameterizations of unidentified VOCs. But the observed OA/CO2 ER actually decreases, presumably due to fragmentation and volatilization of the OA. So in a sense, the authors are attempting to model this decreasing ER, with a process that largely generates increasing ERs, while at the same time not disturbing the gas phase chemistry too much. The authors need to discuss this clearly in the introduction and provide a clear statement of the problem and the goals for this analysis.

One key aspect that is not well explained is the source and meaning of the SVOC concentrations used (Table 4). I looked through the paper but did not find this information, nor is it contained in the caption to table 4. One possible explanation that the authors skip over is that the concentrations of these SVOCs are significantly over-estimated. This needs to be discussed and error bars on the SVOCs should be included.

On structure, I found the first part (ASP results with no unidentified SVOC chemistry) straight forward and well done, but was completely surprised that OA was ignored here. It is critical to describe how well the model does with OA with no unidentified SVOC chemistry, as this is the context that sets the stage for the next section and justification for including additional SVOC chemistry.

Specific comments: Pg 32435, line 8: Unclear what sectional means here.

Pg 32439, line 13: AT this point need to clarify that you will be evaluating the chemistry with parameters in table 5. 32446, : Nothing mentions SVOC yet they are in table 4. How are these concentrations obtained, what is the meaning of the different SVOC values and what is the uncertainty? This is critical information. If the concentration of the SVOCs are over estimated, then this could explain a lot.

32446, line 27: Units on SD.

32447, line 9: Section 2.2 says almost nothing about photolysis. I found myself going back and forth between these two sections trying to find more information. There

are a lot of additional uncertainties on photolysis rates not mentioned. This includes aerosol bleaching over time, observations that show higher SSA, and the wavelength dependence of SSA. Comments on uncertainties?

32448, line 9: I don't understand the value of 1.1e-3, this doesn't sound like its enhanced.

Section 5.2: This section does a good job of describing the results with no additional SVOC chemistry and it seems for gas phase, things are in pretty good shape. You need to summarize this section before moving on. But I was quite confused when section 5.2 said nothing about OA. It seems if the authors want to argue for the importance of unidentified SVOCs, now is the time to make your case. . .. At minimum, you must show the model performance for OA/CO2 for the "no additional chemistry" case and summarize the results of these model runs in section 5.2 before moving on.

32451: Again context needed. The best model fit for OA/CO2 seems to be with no additional chemistry! You need to discuss this and clearly explain why the additional chemistry is justified.

32455, line 11: Unclear what is "average".

Table 4: I assume these are ug C per m3. Key omission of information on SVOC1, SVOC2, etc.

Figure 1: I don't understand why you use O3 – NO instead of the more conventional O3+NO2 for evaluation. It seems there is a mistake in the caption in the equation for delta O3-NO. The fonts in this figure are very small and should either be increased or omitted.

Figure 3: In my print version of this figure, the dashed lines for above plume photolysis have disappeared.

Figure 9: Why is the scale in % when everything else in the paper is g/g? Very confusing.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 32427, 2014.