Other comments:

Line 14 page 2: “to double to triple” this is a bit of a colloquialism.

Line 16 page 2: PAH**s**

Line 29 page 2: … are important and are needed to …

Line 1 page 3: if a few attempts have been made it might be nice to cite them here.

Line 3 page 3: the V in Volatility doesn’t need to be capitalized

Lines 3 – 6 page 3: this sentence needs considerable work.

Perhaps: In the VBS approach, the evolution of the constituent phases (gas and particle) are modelled based on the volatilities of the compounds, …

Lines 6 – 11 page 3: I think there needs to be a link between SOA and gas phase oxidation when discussing MCM. An approach to model SOA is to utilize MCM for the production of oxidized molecules with a parameterization based molecular formula / function group analysis to estimate saturation vapor concentrations, etc… This is what you do when talking about the SOM, but MCM itself is not a way to model SOA.

Line 14 page 3: “All approaches …. differential equation approaches.” Consider rewording

Line 16 page 3: remove: “here the amount of SOA” or reword. The emphasis on here the amount of SOA is not clear the context. Is this the point of the current paper or the current topic you are introducing (SOA models)?

Line 18 page 3: “In this kind of system” Please describe what you mean here.

Line 21 page 3: “Initial compounds cause the increase in products and decrease in their own concentrations” maybe add at the beginning “If a reaction is favorable, the initial compounds result in an increase in the products and a decrease in their own concentrations.”

Page 4: it is mentioned that O3 is put into the chamber to simulate dark aging, where dark aging represents both O3 and NO3 chemistry. It is not clear what concentrations of NOx are in the chamber and why NO3 chemistry would be taking place. It could be helpful to have an experimental table listing the types of experiments taking place and concentrations of relevant oxidants / trace gases.

Line 26 page 4: “intensive” should be ‘the intense’

Line 28 page 4: “their formation products” the formation of what products? HNO3? Molecules making up SOA?

Line 1 page 5: can you clarify how it impacts the composition? Just one line.

Lines18 – 24 page 5: how are the factors determined?

Line 8 page 6: “ but EFA was selected **for** further analysis”

Line 2 page 7: “OH radical has an …” should be: “OH radicals have an …”

Section 2.1.2 within Barmet et al. the OH concentration needs to be determine with reference to another VOC with a known rate constant. For instance:

$$OH\ Exposure = \left(\frac{ln\left(\frac{d_9 butanol}{naphthalene}\right)_0 - ln\left(\frac{d_9 butanol}{naphthalene}\right)_t}{k_{OH,butanol} - k_{OH,naphthalene}} \right)$$

What was the other VOC chosen for comparison?

Line 29 page 9: “evolvement” should be evolution

Lines 30 – 31 page 10: is it reasonable that OH chemistry is not allowed to occur during dark aging? If there is ozonolysis of alkenes taking place, then there will be OH radicals produced. Even if it is a small pathway it shouldn’t be ruled out unless there was negligible dark aging in the presence of O3 alone (without NO_3 chemistry taking place), or if you could model NO3 production to show there is negligible ozonolysis occurring.

Line 15 Page 11: I believe it should say “physical **properties**” because I don’t understand how physical reactions would be what is meant.

Line 32 Page 11 / Line 1 Page 12: should read “ which assessed the measurement error…” omit was.

Line 8 page 12: replace “much” with many

Line 8 page 12: omit the sentence starting with “Additionally” either talk about how it was interesting or remove the sentence.

Line 10/11 page 12: what is “correct structure”?

Line 18 page 12: “which” should be replaced with ‘whose’

Line 20 page 12: what are Mass Action Kinetics system?

Line 31 page 12: RMSE is not defined. (I presume root mean square error, and will assume that is what is meant)

Lines 33 – 34 page 12: Why is this weighting required? Why would some time series not have a standard deviation (standard deviation of what?)? This is not explained adequately.

Lines 3-4 page 13: Why is only 30% of the simulated dataset predicted?

Section 3.1

Lines 24 – 31 page 14: The problem I have with this paragraph is its order. 1) you show the measurement of error in the Tables. 2) there is good agreement! 3) This isn’t surprising. 4) discuss the actual data.

I would suggest rearranging the content so you first say this table shows what you want to show. Then discuss those results, then talk about the goodness of agreement and the overall conclusion.

Tables 3-5 and not intuitive and are not adequately described. For instance, what is “unc_fraction”? or what is nObs? This information is not included in the Table headings. Maybe the tables should be

adapted so they don't appear as if they were just directly taken from a code output. For example: corMean.mean does not convey helpful information. Purely call the column title "Correlation Mean"

Line 31 page 15, what is fittingness?

Figure 5: are there not background measurements? The Figures should all start at 0 on the y-axis. Why do the figures not start at 0 mass loading? What is going on before the initiating of dark aging, are the concentrations stable? Why is the agreement so poor for 3B SOA 1?

Lines 13-14 page 16, why would NO_3 radicals change SOA1 to SOA2? If nitrate is important in this process, then it would be condensed phase process where N2O5 could be uptaken into the particle phase.

Line 14 page 16: why is NO2 attributed here and not NO3 radicals? Because in the gas-phase that is when NO3 chemistry would be important.