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Interactive comment on "Constraining a hybrid volatility basis set model for aging of wood burning emissions using smog chamber experiments" *by* Giancarlo Ciarelli et al.

Anonymous Referee #2

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The manuscript by Ciarelli et al. presents combined chamber experiments with a large ensemble of model simulations, in order to study the volatility distribution and its evolution of organic aerosols originating from wood burning. The work presented is original and of interest to the GMD readers, and the brute-force approach adopted which resulted to tens of thousands of simulations is very informative and helps understand the sensitivity of the system, within the limitations of the work. The degeneration of the large 2d VBS parameter space into a narrower area is also important in future model development in terms of model performance. Although not all possible parameters are studied, and the dependence of results to experimental design and the limitations of past work used in the manuscript is not thoroughly presented, I believe that the work

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Discussion paper

has a lot of value and deserves publication, following my minor comments below. I would like to stress out that the parameter space of such a work is practically infinite, so no study is able to perform all possible sensitivity simulations in a finite amount of time.

Specific comments

Lines 61-62: This is valid only if equilibrium is assumed. Later in the manuscript this is made clear and indeed this assumption is followed, so please add a relevant statement here as well.

Line 138: “simulations” -> “approach”.

Line 139: “physical and error” -> “physical limits and error”.

Lines 161-163: How good is this assumption, given the present literature? How sensitive are the results based on this assumption, if it is not valid? How big a chamber needs to be for this assumption to be correct? Please make a statement here.

Line 188: Is the range 0.1-1000 both for the low-volatile and semi-volatile compounds? Regardless, can you please present individual ranges for each of the two groups of volatilities?

Lines 218-219: Why resulting biases cancel out? And, even more, what do the GCMs have to do with this?

Lines242-245: I got really confused with the calculations here. Where do these numbers come from? How many oxygens are added per oxidation step? Also, probably relevant with this discussion, how many oxygens are contained in the most volatile group at emission time?

Lines 326-328: This is a great result, which demonstrates the value of the modeling approach. Understanding that this is outside the scope of this work, if a statement can be made on potential applicability beyond wood burning, it would greatly enhance this

statement.

Line 357: The 4.75 factor is a very useful number that comes out from this work. How does this compare with other estimates (e.g. Shrivastava et al., 2008; 2015), and why it is different? How much does it change when different types of wood are burned (e.g. tropical vs. boreal forests, domestic heating, cooking)?

Line 370: Maybe a better term for “injection amounts” is “ambient concentrations”? The partitioning depends on amount present, not a flux.

Line 402: “confirm previous observations”: which? Please don’t just add a list of references, be explicit.

The manuscript ends very abruptly. Where is the conclusions section? Maybe some implications of how things are modeled right now compared to this new approach? Any future plans for similar studies on organic aerosol sources other than wood burning?

A statement that is not really present in the manuscript is how results might change if different experimental conditions were to be used for the chamber experiments. Can the proposed mechanism here be used in a global model, under the wide range of ambient conditions and different types of wood burning around the globe? How valid (or not) is an extrapolation from the studied conditions to the global scale?

Code and data availability: The way I read the statement is that the code is NOT publicly available. Please correct me if I am wrong, but if this is indeed the case, I am not certain if this is ok with GMD guidelines.

Figure 1: In my printout the red color is too dark, and the black text inside it is hard to read. Consider using a lighter color in the bars.

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