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Interactive comment on "Experimental investigation into the volatilities of highly oxygenated organic molecules (HOM)" *by* Otso Peräkylä et al.

Anonymous Referee #2

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Highly oxygenated organic molecules (HOM) play an important role in new particle formation, early growth and constitute a large fraction of secondary organic aerosol. To assess their role in these processes better, their volatilities should be known. However, their structures could so far not be identified and there are no easily accessible surrogate compounds. In this paper a method is presented to determine the volatility of HOMs. Ozonolysis of alpha-pinene was performed in a simulation chamber until a steady state concentration of HOMs was reached. After injection of a seed aerosol a new steady state concentration of HOMs was obtained. From the difference of the concentration of the two steady-states the volatility of HOMs could be derived. Using the chemical composition of the HOMs a relation between their volatility and their car-

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bon, hydrogen, nitrogen and oxygen numbers was derived. It was found that volatility does decrease less with addition of an oxygen atom than predicted by other parameterizations reported in literature. Furthermore, the experiments were well simulated with the ADCHAM model. The results presented in this study are of high interest and well suited for ACP. The method used here is well suited and the experiments and data analysis were well done. The paper is also well written and I recommend publication of this manuscript. There are a few points I would like the authors to clarify or add some more information and I also suggest some more additions to put the results presented here into the perspective of other works.

Major comments: The main assumption for the analysis is that the source terms stay constant upon seed addition. The authors note that RO2 radicals decrease by less than 20%. Now, the main reaction path to HOM for NOx-free conditions is by RO2+ RO2, since the RO2 concentration is much higher than HO2. Thus, the HOM formation rate could decrease considerably (40% max), if the total RO2 concentration would decrease by 20%. Could you comment on this.

Page 16, line 33ff: Do you see difference for both types of seeds at 40% RH compared to 1% RH? It is difficult to see the differences from Figure 6. Would it be better visible using a scatter plot between the two RH systems? The condensation sink is calculated from the dry seed diameter. At 40% RH the particles are larger. How much would this influence the fraction remaining?

Figure 7: The observed values seem to be systematically lower than the modeled ones at lower fraction remaining. It looks like there is still a sigmoidal dependence. How was the weighting of the signals done? Does it strongly influence the fit?

Page 20, line 1ff: I suggest to also show in this discussion an example for a known compound of higher volatility, e.g. pinic acid, pinonic acid. I have the feeling that this relationship only holds for compounds with multiple peroxy groups.

Table 1: It is difficult to grasp all the information in the table. I suggest to present it

also in a figure O:C versus log C*, as it is often done in literature. This could make the dependencies better visible. Furthermore, could you also compare your volatilities with other measurements, e.g. from FIGAERO (D'Ambro et al., Earth & Space Chemistry 2018, 2, 1058-1067; Schobesberger et al., ACP 18, 14757-14785, 2018). Although these measurements are from the particle phase they still cover similar types of compounds.

Page 22 line 11; Figure A2: The authors suggest to use their new parameterization in future studies. In the simulation of Figure A2, their model uses the SIMPOL parameterization. I wonder, how their new parameterization would affect the simulation? Does it give similar results?

Minor comments: Page 1, line 18: Replace hyrdoxy by hydroxyl. This also occurs several times later in the text.

Page 4, line 20: Did you also correct for hygroscopic growth as in Dal Maso et al.?

Page 12, line 10; Here you say that you excluded compounds with SD-to-signal ratio higher than 4. How can you evaluate a signal at such high noise? In Figure 5 it says compounds with a signal to noise ratio above 4 have been excluded and on page 18, line 13 it states compounds with a signal to noise ratio below 4 have been excluded. I assume only the last statement is correct.

Figure 2: Color of shading is different from what is stated in the Figure caption.

Figure 3: You report here experiment seven. How can you model this without knowledge of CS during SS1?

Figure 5: Is the scaling linear?

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