

Interactive comment on “Influence of the vapor wall loss on the degradation rate constants in chamber experiments of levoglucosan and other biomass burning markers” by Amelie Bertrand et al.

Anonymous Referee #1

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The authors present very valuable data, regarding the influence of vapor wall loss on rate constants in chamber experiments. This is a very important study needed to make sense of laboratory chamber results and make accurate interpretation/comparisons with field studies. The paper addresses relevant scientific questions within the scope of ACP.

However there are some major issues that need to be looked at and proper justification and scientific validity needs to be provided to the assumptions made throughout the paper before publication.

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1. The paper talks about laboratory experiments and simulations. However the laboratory studies are not described sufficiently. What are the experimental results? The results section goes to the simulations directly.

2. The particle wall loss rate in these studies is assumed to be constant independent of the size of the particles. The constant used is much higher than what is in literature for wall losses of biomass burning aerosols.

Particle wall loss rate for biomass burning particles for 100 nm size was estimated to range from .147 h⁻¹ to 0.45h⁻¹ See for example chambers KNU: Kyungpook National University (Babar, 2016). TU: Tsinghua University (Shan, 2007). GIG-CAS: Guabgzhon Institute of Geochemistry-Chinese Academy of Science (Wang, 2014). Ilmari University of Eastern Finland (Leskinen, 2015).

For polydisperse aerosol the wall loss rates range 0.17 h⁻¹ , 0.209 ± 0.018 h⁻¹ , and 0.09–0.18 h⁻¹ , respectively (Wang et al., 2014; Paulsen et al., 2005; Cocker et al., 2001). The particle half-life in our remarkably longer than, e.g., the 2.8 ± 0.8 h⁻¹ in the PSI mobile chamber (Platt et al., 2013) cited in this work. Most chamber studies have also shown that the loss rate is highly dependent on particle size, and the overall decrease rate of the total number concentration depends on the size distribution of the inspected aerosol, which makes an exact comparison difficult.

Furthermore particles studied in the PSI mobile chamber are diesel emissions which may not be the same as biomass burning aerosols. This distinction should be addressed.

It is not clear how such a very high loss rate affects the simulations, and repeating the experiment using the known values in literature for Biomass burning aerosols may be helpful.

3. A recent work not cited in this paper by Q. Bian , A. A. May , S. M. Kreidenweis , and J. R. Pierce “Investigation of particle and vapor wall-loss effects on controlled wood-

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smoke smog-chamber experiments “Atmos. Chem. Phys., 15, 11027–11045, 2015. Needs to be considered as this work addresses the same issue and results need to be compared. Furthermore this work uses time and size dependent particle wall loss equations in the simulations.

The size dependent wall loss rate is more realistic and should be used in the simulation and convince readers that the results are independent of the particle size.

The authors also assume vapor wall loss as constant. Again how valid is this assumption? It depends on surface to volume ratio of the chamber and mass accommodation coefficient etc. The authors need to look at the above work by Bian et al. as well and the references provided in there.

4. How can the increase in mass concentration of OA upon aging be explained if there is wall loss?

5. An estimate of the concentration of condensable vapor and its source rate may be important. The assumptions here need to be stated.

6. Conclusions should compare experimental and simulation results in more detail.

Minor points:

Page 2-Line 2: “. with consequences on our health and climate..” better say with consequences on health and the climate..

Page 2-Line 22: The sentence starting with “ the extent to which “ is confusing

Page 2-Line 23: “In general manner they influence. “ remove manner

Page 4-Line 26: “The particle phase of the emissions is lost to the walls”. It is the particles that are lost not the phase of the emission.. Consider rewriting.

Page 5-line 5: “.. before lights on in. . .” please change to .. before lights are turned on..

Page 9- line 30 “. condensation sink is on a few seconds.” Remove “on”

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