Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-1132-RC2, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Predictions of the glass transition temperature and viscosity of organic aerosols by volatility distributions" *by* Ying Li et al.

Anonymous Referee #2

Received and published: 29 April 2020

Review of:

Predictions of the glass transition temperature and viscosity of organic aerosols by volatility distributions

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Discussion paper

1 General Comments

The manuscript by Li et al. extends the previous parameterizations of the glass transition temperature (Tg) based on the vapor pressure of a large number of pure organic compounds. The authors explore several parameterizations and use them to estimate ambient organic aerosol viscosity. The diversity of parameterizations is useful but can be distracting form the take-home message of the manuscript. After revisions of the modeling description and discussion section, this manuscript should be published.

On the content of the manuscript, the main points I take away are the new parameterizations and their modeling of ambient data. Some of the details presented deviate from this main narrative (i.e., multiple FIGAERO-CIMS analysis), so even though the details may be necessary for the calculations, they distract from the narrative. I would suggest putting details that are not key to manuscript narrative into the supplemental information, which will help improve the message of the manuscript.

1. Parameterizations section: This section needs subsections to delineate the different models. Also tell the reader which of these parameterizations is most important to focus on for the rest of the paper. Or you could add an introduction paragraph to this section, where you discuss the merits of each model parameterizations. A revision along those lines would help focus the narrative of the manuscript.

2. Figure 1-3: These Figures do not stand apart very well, and conceptually blur. If you delineate the parameterizations more, that will help in understanding the importance of each Figure. To me, Figures 1b and 1c convey similar information (i.e., good predictive behavior), so show one and put the other in the SI. The O:C ratio coloring could be removed (since the lack of correlation could just be stated

in the text) and instead color by functional group. Figure 3 could be replaced in a table that summarizes the AAVRE and R-squared values.

3. Field Observations: Line 259: I suggest adding a sentence motivating why Figure 4 is shown and what the reader will gain from it. I take away that viscosity can be estimated from C* measurements and ambient OA spans solid to liquid states depending on the method used, was that the main message?

4. Line 286: The discussion of the FIGAERO-CIMS analysis can be shortened, as the main point starts at Line 312.

5. The added value of Figure 8 seems to be limited. If the goal is to show how well the CTM model output and your Tg models agree, this is not the ideal way to show that. It would be clearer to pull the viscosity values for each of the 11 sites from the CTM output and make a scatter plot vs. the measurement derived viscosities. The actual global distributions are irrelevant for this comparison, and instead, point the reader to the Shiraiwa et al. (2017) paper.

6. Conclusion/discussion: I think a short conclusion or discussion would help tie the previous treatise of field observations and put them in a broader context. This is already started at Line 477 and should be expanded on.

2 Line Comments

1. Line 259: I would stray away from starting a sentence with a variable, as doing so reduces readability (and this paragraph does it repeatedly). So it would change to, “The Tg of ambient...” and line 262, “These Tg values are then placed...”

2. Figure 6a: I suggest filling in the dots, with the edge color (TOA, OOA, ...). The Tg fill color is already represented by the contour lines.

3. Figure 6b: You have already shown the correlation between Tg and C* (Figure 1a), so the added value to the manuscript is small. I suggest moving Figure 6b to the SI.

4. Figure 7 caption: Define BBOA, LO-OOA, and MO-OOA. I didn't find the definitions in the main text.

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