In this paper, Tsimpidi et al. performed different sensitivity tests with the global chemistry-climate model EMAC in order to investigate the main parameters affecting the evolution of organic aerosol from combustion sources. Different assumptions on primary organic aerosol emission inventories, volatility distributions and reaction rate constants of SVOCs and IVOCs against OH are investigated. In addition, the authors deployed alternative aging schemes as well as different values of the Henry's law constant to test the effect of wet removal of SVOCs and IVOCs from the atmosphere. The ORACLE module, based on the VBS framework, is used within EMAC to model the evolution of OA in the atmosphere and results from the sensitivity tests compared against a comprehensive set of AMS measurements performed during 2001-2010.
The paper deserves publication, the results are well presented and the adopted schemes are appropriate for the analysis.
I recommend the paper for publication after considering the minor comments below.

Line 33: a more recent reference is needed.

Line 38: "*which can reduce their volatility*".
In recognizing that the main point of the sentence is to describe the formation of SOA, it would be desirable to mention the increase in volatility due to fragmentation as well.

Line 48: Please consider adding Jo et al., 2013 who has also investigated the effects of chemical aging on global secondary organic aerosol using the GEOS-Chem model and compared the model results against AMS datasets.

Line 142: What is the thickness of the first layer ? Please add this information.

Line 163-166: "*The volatilities of SVOCs and IVOCs are reduced by a factor of* 10^2 *as a result of the OH reaction with a rate constant of* $2x10^{-11}$ cm^3 $molecule^{-1}$ s^{-1} *and a 15% increase in mass to account for two added oxygens (Tsimpidi et al., 2014)*".
Does the model include any fragmentation pathways as well ? Please specify if fragmentation is directly/indirectly accounted for.

Line 170: Were shipping emissions taken into account ?

Line 359-362: "*On the other hand, OOA concentrations are underpredicted (-31%; Table 3) indicating that the model may be missing an important source or formation pathway of SOA especially in winter (Tsimpidi et al., 2016) or may be removing the corresponding pollutants faster*".
Please add the uncertainties in SOA yields due to wall loss in chambers as another possible reason for the underprediction of SOA. In the authors opinion, how much do vapor wall losses influence their results ?

Figures 4-5-6 and 7: In general, it seems that for all the sensitivity tests almost no changes are observed in the Scandinavian region. Is this simply because of the low SOA concentration predicted in this area of the domain ? Or are there other reasons ?

Line 638-641: "*Therefore, we expect that the discrepancy in this season is related to sources that are missing or underestimated in emission inventories, such as residential wood combustion in winter (Denier van der Gon et., 2015) and additional oxidation pathways*"
Here the important sources are clearly stated (i.e. residential wood combustion). Please add also explicitly the additional oxidation pathways that could be missing and the uncertainties in SOA yields due to wall loss in chambers.

Line 687-689: "*Nevertheless, SOA was still underpredicted during winter (NMB = -76%) indicating*

that other processes (e.g., seasonally dependent emissions and alternative oxidation paths) are a main cause of the inadequate performance"
Also in the conclusion part, I would explicitly mention the possible underestimation of residential wood combustion emissions as a possible reason for the underprediction of SOA during winter. Please consider adding more explicitly which additional oxidation pathways could be missing and again the uncertainties in SOA yields due to wall loss in chambers.

REFERENCE

Jo, D. S., Park, R. J., Kim, M. J. and Spracklen, D. V.: Effects of chemical aging on global secondary organic aerosol using the volatility basis set approach, Atmos. Environ., 81, 230–244, doi:10.1016/j.atmosenv.2013.08.055, 2013.