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Comment on acp-2021-655

Anonymous Referee #2

Referee comment on "Simulation of the effects of low volatility organic compounds on aerosol number concentrations in Europe" by David Patoulias and Spyros N. Pandis, Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-655-RC2>, 2021

The manuscript "*Simulation of the effects of low volatility organic compounds of aerosol number concentrations in Europe*" by Patoulias and Pandis presents a model investigation on how including extremely low volatile organic compounds and intermediate volatility organic compounds affect simulated aerosol number (and mass) concentrations. The manuscript is very well written and the topic of the paper addresses relevant scientific questions within the scope of Atmospheric Chemistry and Physics. There are few models around that can simulate the formation and growth of aerosol by gas-to-particle partitioning of semivolatile organic compounds as detailed as PMCAMx-UF. Although the results indicate that these compounds have a minor effect on aerosol number concentrations over the studied region, it is an interesting result.

I recommend publishing this manuscript once the following minor points have been addressed:

- In the model description, it is laborious to piece together the methods that the model uses for aerosol physics since the description relies on referenced articles. For example, solving condensation of inorganic and organic compounds simultaneously remains unclear to me. It seems that organics are always assumed to be in a separate phase from water and inorganics. Is this correct? In addition, it seems that water uptake uses a parameterization for bisulfate. Is the amount of sulfate equal to the amount of bisulfate in particles? Are organic compounds assumed to be hydrophobic?
- It would also be helpful for the reader to summarize the ELVOC yields and IVOC emissions in a table.
- Line 174: Murphy at al. => Murphy et al.
- Line 183: Are IVOCs additional to POA?
- Is modelled OA in PM_{2.5} and filter measured OA in PM_{2.5} fully comparable as part of semivolatile compounds in filter samples can be evaporated while modelled OA will include all semivolatile material?
- In Conclusions Lines 485-489 it is said that the growth of the newly formed particles is suppressed because changes in size distribution decrease nucleation rates, sulfuric acid

concentrations, and increase the coagulation sink. However, these changes are not backed up with numbers. This conclusion is probably true, but needs to be diagnosed from the model.