

***Interactive comment on* “Experimental study of H_2SO_4 aerosol nucleation at high ionization levels” by Maja Tomicic et al.**

Maja Tomicic et al.

majatomicic34@gmail.com

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First, thank you very much for the comments.

Generally, the study was intended to apply to atmospheric conditions in the lower troposphere. The total pressure in the chamber was 1 bar, as in the lower atmosphere, but at ~ 0.1 mbar overpressure with respect to the surroundings to reduce contamination from the laboratory air. The temperature was held at around 295 K which is relevant for the lower atmosphere as well. We note that the highest ionization levels investigated in this study would most likely be found at higher altitudes (~ 10 km) where the temperature and pressure are lower. In this region the

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chosen parameters might not apply. However, we still consider the chosen parameters appropriate since they allow us to extend the parametrization from Dunne et. al (2016).

We will consider adding a discussion about how pressure and temperature affects nucleation and thereby our results. We will clarify the choice of the mentioned experimental parameters in the final version.

Our response to the specific comments :

RC 1.1: *“They say O3 was added to the experiment chamber. Why is that? I did not find an explanation of why this was done, or the concentration added. It is important to consider what effect O3 may have on the processes involved. “*

O₃ was added to allow for formation of H₂SO₄ via photolysis by UV light. The concentration was between 20-30 ppb which corresponds to concentrations in the lower troposphere. Apart from the photolysis ozone could oxidize eventual organic impurities in the chamber which may participate in the cluster formation similarly to how it happens in the atmosphere (Dunne et al. 2016). We will mention the concentration of O₃ in the final version along with the concentration of SO₂ (which was 0.6-0.9 ppb).

RC 1.2: *“Similarly, they say the pressure was held at 0.1 mbar. This is very low pressure compared to atmospheric pressure in the lower and even middle atmosphere.”*

We state that the pressure was held at 0.1 mbar overpressure, and realize that this is not expressed clearly enough. We will rephrase this in the final version clarifying that the pressure was held at standard pressure of ~1 bar with a slight overpressure

relative to the surroundings.

RC 1.3: *“Likewise, they say the temperature was held at 295 K, which is relatively high compared to that in most of the atmosphere above ground level. These choices need to be explained.”*

It would be preferable to perform the experiments under varying temperatures, however, due to lack of equipment and time constraints this was not possible. A temperature of 295 K is relevant for the lower troposphere. In addition, this temperature is close to one of the temperatures used in the study by Dunne et al. (2016). Since we compare our results with this study and use our results to expand their parametrization we consider 295 K to be an appropriate temperature. We will consider adding a discussion on the temperature influence on nucleation in general.

Technical corrections: *“I found one typo; on page 12, in the next-to-last paragraph of section 4, “where” should be “were” in the sentence “When the experiments where fitted. . .”*”

Thank you for the technical correction.

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