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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Laboratory and modeling studies on the effects of water and soot emissions and ambient conditions on the formation of contrail ice particles in the jet regime" *by* H.-W. Wong et al.

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We thank Prof. Cziczo for providing insightful and constructive comments in improving our manuscript. We have listed our responses to the comments point by point below.

1) At several locations in the text a comment is made that in the absence of soot and sulfuric acid "homogeneous ice particle formation was unfavorable." If soot was not placed in the chamber are ANY particles in the experiment? If not then this isn't purely "homogeneous ice formation" as there would first need to be some type of particle nu-

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cleation and growth step. If this is the case then I don't see how these two experiments could be compared. Can you comment on this?

Response: By saying "homogeneous ice particle formation", we referred to "ice particle formation from homogeneous nucleation followed by homogeneous freezing of liquid water". We have revised the manuscript accordingly. During our experiments, a background particle concentration between 10 and 400 cm-3 was measured. We have stated in the revised manuscript that although these particles may serve as ice nuclei, no ice particles were measured from the OPCs and observed from the video snapshots in our measurements.

2) One reason I bring up point 1. is that the paper contains the statement that no aerosol is in the chamber as this "avoids the possible introduction of undesired ice nuclei that may be contained in the chamber humidification air." As a second point of concern the real atmosphere around and behind jet exhaust would contain some IN (and even more homogeneous freezing nuclei). Can the model be used to see what effect this has? Can the chamber contain an atmospherically relevant number of particles as well?

Response: The PAL facility can be used to study the effect of ambient particles in a well-controlled manner. The existing model, however, does not have the capability to study the effect of ambient particles. The reason we have not focused on ambient particles in these first studies is that in a near-field aircraft exhaust plume, the emitted particles are in a much higher concentration than ambient particles (e.g. there are typically 107 cm-3 soot particles at the engine exit plane), even considering plume dilution within the first few seconds. However, intentional injection of ice nuclei (such as silver iodine) in the PAL and associated modeling studies are planned in our future work.

3) It would be useful to see the experiments on a diagram of temperature versus ice supersaturation which contained the liquid water saturation line and the homogeneous

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freezing line (as given by Koop et al., Nature, 2000) which is the manner ice nucleation experiments are normally displayed.

Response: We have added a new figure (Figure 2) in the revised manuscript to describe liquid water and ice supersaturation versus plume temperature. As suggested by the anonymous referee #1, we use the Schmidt-Appleman representation instead of the Koop representation. Interpretation of the figure is also added in the revised manuscript.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 26791, 2011.