Atmos. Chem. Phys. Discuss., 9, C9766–C9768, 2010
www.atmos-chem-phys-discuss.net/9/C9766/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "An aerosol chamber investigation of the heterogeneous ice nucleating potential of refractory nanoparticles" *by* R. W. Saunders et al.

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Received and published: 16 January 2010

The authors thank both referees for their positive reviews of the paper and for their constructive suggestions for its improvement.

Responses to points raised by Markus Rapp (referee #2).

1. Mass accommodation value: Text has been added to stress the lower mass accommodation value found in this study compared with that assumed in NLC modelling to date. This lower value is consistent with those previously reported from experimental studies - citations on page 23292 (lines 20-21).

2. Paper citation for MSP detection: The suggested paper by Strelnikova et al has been added in place of Rapp et al to stress that the detection of charged MSPs has been shown to be feasible using radar.

3. Laser polarisation: Specified as suggested.

4. Figure font sizes: These have been increased as suggested.

5. Alternative plot: The referee is quite right that the bottom panels in Figure 3 do not give any quantitative information for these nucleation runs. However, this was not the purpose of these panels, which was merely to display the onset of ice formation and subsequent growth for referral to the panels above for which quantitative information is given. We would therefore prefer to leave this figure in its current form, particularly as the ice number fraction variation with RHi (the critical parameter) is shown in subsequent plots.

6. Particle loss significance: We would not claim that the particle losses in the chamber due to pumping dilution were irrelevant, but that, on the timescale of a typical expansion run (with ice cloud formation), loss of small particles to the chamber walls and settling of the largest of particles to the bottom of the chamber is small enough (< 5% of total number) to be of negligible importance to the analysis made from each chamber experiment. This has been added to the text.

7. MSP sizes in mesosphere: In terms of the upper atmosphere and NLC formation, smoke particle sizes are indeed likely to be smaller than the stated size of primary particles of which the larger aggregates are formed. Such particles will have similar chemical compositions and be essentially amorphous in nature having been formed from gas-phase condensation. At such small sizes, these particles are likely to be spherical. However, not only is it unfeasible to generate high enough numbers of particles at such small sizes using the aerosol generator at the AIDA chamber, but state-of-the-art instrumentation is currently limited to particle detection at sizes greater than is realistic for the mesosphere. With regard to the conclusions made in the lower and middle

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atmosphere, coagulation processes will lead to particles growing beyond the primary size and forming aggregates. We have therefore expanded the qualifying statement (page 23293) which points out these experimental constraints and the limitations of the conclusions with regard to sub-10 nm particles in the mesosphere.

8. Alternative citation for upper atmosphere wind speeds: Citation changed as suggested.

9. Ice particle number densities in the mesosphere: Text has been added to indicate higher ice particle numbers responsible for PMSE and the suggested reference has been added.

10. Ion-induced nucleation citation: Citation changed as suggested.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 23271, 2009.