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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Insights into the role of soot aerosols in cirrus cloud formation" *by* B. Kärcher et al.

Anonymous Referee #1

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Understanding the role of anthropogenic and natural soot emissions in altering cloud properties remains an elusive goal for atmospheric scientists. The aircraft contribution is particularly relevant because it derives from an important global transportation sector that is highly regulated. This manuscript underscores the elusiveness of quantifying soot effects by presenting a comprehensive discussion and modeling treatment of the processes by which aviation emissions alter cloud properties. The manuscript is well-written and well-organized, and has a lead author who is experienced and well-respected in the field. A shorter manuscript is preferred. I recommend publication after the authors consider some minor comments and suggestions.

Specific comments The large number of uncertainties noted in the manuscript are associated with various aspects of the microphysical properties of soot and its effect on

clouds. It is the shear magnitude and importance of these uncertainties that critically limits the authors' ability to draw strong and definitive conclusions about the role of soot. Examples are 'the size distribution of aircraft soot emissions remain uncertain' (p4 left bottom) and 'our assumptions about relative contributionsĚ cannot be accurately constrained' (p5 left top) The reader encounters these uncertainties and limitations separately in the text making it difficult to assess them as a group. My suggestion for strengthening the manuscript is to collect these uncertainties in a table(s) or graph in some logical or priority order. This will draw more attention to the procedural barriers we still have in addressing this problem and provide a convenient point of focus for those readers that would like to consider how to proceed to reduce uncertainty. A further idea is to adapt and update the aerosol flow diagram in the IPCC Aviation Report (Figure 3-1) (1999) showing aerosol plume processes in order to illustrate the plume-to-cloud steps being discussed in this manuscript.

Figure 1 seems too simple for this discussion and might be replaced by the adapted/augmented Chap. 3 figure noted above. For example, the word 'soot' does not appear in Figure 1.

The last figure, that of satellite observations, seems out of context, particularly since the authors equivocate in stating the relevance of the figure to the role of soot, and hence should be considered for removal.

The role of humidity and the uncertainty in the occurrence frequency of supersaturated air masses at cruise altitudes seems to be understated.

A principal motivation for understanding soot processes in a timely manner is that aircraft operations fall under stringent international regulations for environmental effects and changes in aircraft technologies for mitigation or other purposes have very long lead times. A comment recognizing these facts would be useful on p2 top left.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 7843, 2007.

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