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

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The single major concern is the length of the manuscript. To satisfy this concern, we remove Fig.10 from the manuscript. However, we like to keep the discussion of contrail cirrus versus soot-induced cirrus. According to our experience, soot effects and contrail effects on cirrus are quite often not clearly separated in the literature. The Sect. 1.1. was intended as a contribution to clarify this issue.

The reference to be added to support the statements about condensable aldehydes is Yu et al. (1999) already cited in the manuscript, in which it is also acknowledged that the organic composition is not well characterized.

Constant BC volume fraction means that soot particles in background aerosols contain the same amount of black carbon by volume for any given size. This amount is given in

Table 1, last column for each of the four background aerosol cases. This assumption is made in the absence of more detailed experimental information about partitioning in particles between BC, sulfate, water and other components across the particle size distribution.

The approximate cross-section of the plume after 24 hours is of order 10^6 m^2.

Approximate thicknesses of sulfuric acid coatings on soot cores can be inferred by dividing SA over BC volume fractions (V) in particles of the same size. Such information is given in Fig.7. The SA and BC volume fractions shown there are strongly size-dependent and differ even at a given particle size, in particular for the particle types MX. The situation is simpler for particle types A+VA (volatile aircraft particles that coagulated with ambient soot-containing particles) and VN (emitted soot particles that coagulate with SA containing aerosol). For instance, from Fig.7, we estimate

$$\frac{V_{\rm SA}}{V_{\rm BC}} = \frac{4\pi\rho_{\rm SA} r^2 \Delta r}{4\pi\rho_{\rm BC} r^3/3} = 3\frac{\rho_{\rm SA}}{\rho_{\rm BC}}\frac{\Delta r}{r} \simeq 0.03$$

for VN particles in case ACC with diameters $D \simeq 0.1\,\mu$m. (Here ρ are bulk mass densities.) We obtain $\Delta r/r \simeq 0.012$, or a coating thickness $\Delta r \simeq 0.6$ nm, i.e. these particles are almost bare. Unique coating thicknesses cannot be given for all particles and sizes and SA coatings alone may not be sufficient to describe the ice nucleation behavior when organics contribute to the soluble mass. Because of those and other caveats expressed in our study, we refrain from providing such detailed information in the manuscript. In fact, on purpose, our scenarios (A) and (B) (p.7877) remain qualitative in terms of soot ice nucleation behavior (bare particles vs thick coatings, or deposition vs immersion nucleation) because of the many unresolved issues.

The recent references showing little to modest IN activity of soot particles in the immersion mode have been given on p. 7869. Note that p. 7871 is only a summary in which we did not want to repeat all references.

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