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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Selected topics on interactions between cirrus clouds and embedded contrails" *by* K. Gierens

Anonymous Referee #2

Received and published: 9 December 2013

This manuscript investigates the role of natural cirrus clouds for the formation and development of contrails. The manuscript is well structured: it starts with explaining the background and listing four questions at the beginning, then these questions are addressed with an interesting mixture of basic principles, analytic formulations and first order time scale estimates, and finally it summarizes and concludes with clear answers to the questions addressed at the beginning. The topic of the manuscript is well in the scope of ACP. The nice collection of formulations and estimates for contrail-cirrus interaction as well as the results of the manuscript are of interest for the atmospheric sciences community. I like the structure and style of the paper, however some parts deserve language polishing to improve readability.

I recommend to accept the paper for publication in ACP with only some minor changes

as listed below.

Specific comments and questions

First of all please double-check the title for proper language use. I would recommend to change it to either "Selected topics on the interaction between . . . " or "Four questions regarding the interaction between . . . ".

p. 25240, l. 15: "Contrail formation requires the relative humidity to reach (or to exceed?) water saturation . . . if water saturation is exceeded (condensation of water requires supersaturation), the water that condenses . . . ". Actually I do not understand this criterion, because the emitted soot contains some soluble material (sulphate, organics), therefore take up water upon increasing relative humidity and should freeze already below water saturation. Also the emitted sulphate and organics particles should freeze well below water saturation.

p. 25242, l. 18: Please be more specific here. It is unclear what is set together. And what is ϵ? Not sure if I saw this parameter beeing defined before. How is τ_{jet} defined? What EI_{H_2O} index was used?

p. 25243, l. 9-14: Why does the condensation to dynamic jet time scale ratio only depend on the crystal number concentration? I would expect the ice particle surface area and therefore the size distribution parameters also to have an influence.

p. 25244, l. 20 ff.: I suspect that many readers, like me, are not very familiar with moment formulations. Therefore I recommend to explain μ_b and other terms here in more detail.

Minor points and technical corrections

p. 25239, l. 7: Generally, the questions . . . (such a comma may also be added at other places throughout the manuscript).

p. 25240, l. 3: Please explain what mixing ratio you mean here (probably water mass

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to air mass ratio?).

p. 25240, l. 9-11: Please re-phrase.

p. 25241, l. 6: Please do not use abbreviations (rhs) without explanation.

p. 25243, l. 14: Better “to efficiently reduce” or “to stop”

p. 25244, l. 8: Now, if only contrail ice is present, . . .

p. 25248, l. 3 (Eq. 21): Am I right that this is just the time scale for a cirrus crytal to collect one contrail crystal, but that the rate of overall aggregate formation is N_{con}/τ (see Eq. 18)? If so please mention.

p. 25253, Fig. 1: The Figure is too small.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 25237, 2012.