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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Parameterizing the competition between homogeneous and heterogeneous freezing in cirrus cloud formation – monodisperse ice nuclei" *by* D. Barahona and A. Nenes

Anonymous Referee #2

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Barahona and Nenes developed a parameterization of heterogeneous versus homogeneous freezing for cirrus clouds in large-scale models. The topic of the importance of homogeneous vs. heterogeneous freezing is very relevant as the importance of heterogeneous freezing for cirrus cloud formation is not yet established. The parameterization is developed from a numerical parcel model and seems to perform well when compared the numerical parcel model. The topic is certainly relevant for ACP and the parameterization is novel warranting publication in ACP after the following comments have been addressed.

My major comment is similar to that from referee 1 such that the comparison with existing parameterizations seems a bit arbitrary. Given that the authors state that Kärcher et al. (2006) present the first comprehensive physically-based parameterization for cirrus formation, it seems odd that this parameterization is not used for comparison. I am happy to see that you agree to add this comparison. This is very much needed.

p. 15666, l. 13: Lohmann and Diehl (2006) did not investigate cirrus clouds, but mixed-phase clouds. The proper reference might be Lohmann et al., JGR, 2004

p. 15669, l. 9-15: It is not true that Kärcher et al. (2006) consider either homogeneous or heterogeneous nucleation. They do parameterize the competition between homogeneous and heterogeneous nucleation. Also, I do not understand why the authors say that the dependence of the ice crystal number on the heterogeneous freezing threshold and the number of IN cannot be unraveled. That is not true. The dependence on IN is presented in the Kärcher et al. (2006) paper (see also comment by Bernd Kärcher)

p. 15671, l.1-3: Explain the physical reasoning behind going from eq.1 to eq.2.

p. 15671, l.10: What is the timescale of Smax? Please add

p. 15671, l. 17: How long does the freezing pulse last? Please add

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 15665, 2008.