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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Dust ice nuclei effects on cirrus clouds" *by* M. Kuebbeler et al.

**Anonymous Referee #1**

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Review of "Dust ice nuclei effects on cirrus clouds" by Kuebbler et al.

This manuscript describes a new ice nucleation scheme in the ECHAM General Circulation Model. It describes the scheme and presents results and comparisons to observations. The manuscript is generally well written and contains original material suitable for publication in ACP. I have a few concerns that probably warrant significant revisions. The scheme in ECHAM is probably not described sufficiently. It is not possible for the reader to understand exactly how the scheme functions in the model. Thus it needs a bit more explanation of the scheme application, as I note below. The box model also needs some further description, perhaps a paragragh detailing how it works. I would also suggest that perhaps it would be better to describe the scheme first, then show the box model results. With these changes, the manuscript will be suitable for publication in ACP.



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Detailed comments:

Page 9752, Line 26: Are the effects of preexisting ice and homogeneous nucleaition on dust separable? What is RF of each one?

Page 9755, Line 15: Perhaps the scheme should be described before the box model results presented. Also, I am not clear how the preexisting ice is handled: does the scheme condense mass on preexisting ice, or just remove some mass from the Sice calculation? Some more detail is needed here so that the reader can understand the scheme.

I assume all supersaturation is then removed in the timestep if there are activated nuclei present? Again, more detail is required

Page 9759, Line 11: Please describe the box model in a bit more detail or provide a reference: does it allow for settling as a column? Are there feedbacks between latent heating, temperature and updrafts?

Page 9761, Line 10: How is the down draught calculated? Is it just sedimentation?

Page 9765, Line 2: Extend–>extent

Page 9765, Line 2: A few more sentences on the depositional growth would be helpful. In particular: what sizes are assumed for the growth of each nucleation mode, or how are they calculated and combined?

Page 9773, Line 1: Supersaturation should be plural: supersaturations are.

Page 9773, Line 7: simulations match (plural)

Page 9775, Line 10: Are the LW and SW offsetting contributions in the same regions?

Page 9776, Line 13: What are the vertical updraughts driving the scheme in the model? Are they low or high?

Page 9777, Line 29: Why the big oscillations with different temps that occur in all runs?



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Page 9778, Line 19: But do you have the high frequency gravity waves described by spi thinner and Kramer? What are the vertical velocities in echam? Please restate.

Page 9779, Line 20: Actually: there are significant differences at low temperatures: the data show only supesaturated conditions, while the model does not get high frequency of high supsaturations? Why? Is this the vertical velocity? Now might this be related to ICNC biases in the model ?

Page 9782, Line 10: Results may point? I think you can say they point to the same confusion: "may" is not needed.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 9751, 2013.