

## ***Interactive comment on* “Modelling of cirrus clouds – Part 1: Model description and validation” by P. Spichtinger and K. M. Gierens**

**P. Spichtinger and K. M. Gierens**

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### **1 Reply to reviewer 3 (Anonymous)**

**p 608, l 16:** Aggregation is not yet implemented in the model simply because the code for that process has not yet been developed. We have an idea how this can be done for a 2–moment scheme, but it will need quite some time for elaborating the ideas into something that works. As aggregation is not so important for cold cirrus where small crystals with low terminal fall speeds predominate (Kajikawa and Heymsfield, 1989), we preferred to use the code already without this process instead of waiting for completion. Of course we are aware of the fact that this constraint inhibits the use of the model for cases where aggregation is important. We have added a comment in the manuscript.

**p 611, l 4:** Accepted. We have replaced evaporate etc. everywhere with sublimate.

**p 618, l 1:** See above, reply to Rev. 1, (p 617, l 1–5)

**p 619, l 15:** corrected.

**p 621, l 20:** Figure 5 shows that the correction to the Koenig ansatz is very small over a wide range of crystal masses. So we do not agree that it is overruled by a substantial correction. Anyway, we prefer to leave the derivation of the growth rates as complete as it is because we think it is useful, not only for ourselves, but also for our students and for people interested in using the code. Additionally, as the referee noted himself, the degree of detail allows the reader to follow all the rationales. The figure caption of fig. 5 has been improved, the colours are and have been correct.

**p 626, l 23:** We have deleted the word “usually”; the decoupling does not occur for realistic values of  $r_0$ .

**p 631, l 15:** The reported pressure is in fact the pressure when nucleation starts. Because of the short duration of a typical nucleation event (few tens of seconds) this information is appropriately accurate. We clarified this in the text.

**Fig 18 caption:** corrected.

**p 644, l 3:** The main purposes of the (meanwhile splitted) paper are twofold: First, we want to present our new cloud scheme, and the testing of it. Second, we want to show, how the structure of cirrus clouds is changed at slightly different conditions (large scale dynamics and small scale eddies). The fact that we find persistent in–cloud supersaturation in one case is a side aspect in the paper. It is not published on its own. Much more of this will be presented in Part 2.

1) That in–cloud supersaturation occurs mainly at extremely cold temperatures is not true, see for instance the results of Ovarlez et al.(2002), Comstock et al.(2004), Lee et al.(2004), Krämer et al.(2008) and also the recent SPARC newsletter about the supersaturation issue Peter et al.(2008) We add the references in the manuscript.

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2) That wind shear leads to quicker relaxation to ice saturation is stated in the paper. We do not say that our moderate wind shear is the typical case, but it occurs; see also response to reviewer 1.

3) When there is an ensemble of ice crystals with a size distribution of non-zero width, it is absolutely clear that sedimentation number-flux and mass-flux differ. There is nothing “hand waving” with this. It is clear that still sedimentation is not perfectly modelled in the 2-moment scheme, but this holds for the other processes as well. We agree with the referee insofar that we also would like to see a bin microphysics model applied to that case, but we do not have one. However, the differences between 1-moment, 2-moment and spectral sedimentation schemes were investigated by Wacker and Seifert(2001). Their results show that 2-moment schemes are certainly not as good as spectral schemes, but they are able to represent the main features. Last but not least we want to remark, that our results of the arctic cirrostratus show good agreement with the results by Kärcher(2005) and Lin et al.(2005) obtained with a detailed microphysics including spectral sedimentation. Thus our scheme does a good job to our opinion.

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