Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2017-164-RC1, 2017

Geoscientific Model Development Discussions

Interactive comment on "Prognostic parameterization of cloud ice with a single category in the aerosol-climate model ECHAM(v6.3.0)-HAM(v2.3)" *by* Remo Dietlicher et al.

Anonymous Referee #1

Received and published: 26 October 2017

This paper describes the implementation of a single ice category into the ECHAM6-HAM2 model. Several modifications were needed to the original microphysical scheme do deal with prognostic sedimentation of the new single ice category. The authors show the impact on including sub-stepping or the sedimentation in the microphysical scheme, based upon previously published studies. Further, they use the single ice category scheme developed by Morrison and Milbrant (2015). The use of a single ice category in both regional and climate models are becoming more tractable. I would have liked to see this scheme tested in a full global run, but that might be too much to

add at this point. So I believe this paper can be published after a few minor changes.

Abstract: Mention new single ice in CAM, but not in the main body. Somewhere in the introduction mention that MM15 is included in CAM.

Page 4, line 1: What is the relation ship between mu and lambda? I suggest giving the equation. Page 4, lines 2-6. Can this sentence be simplified? Perhaps split into two for easier reading.

Page 4, line 14. It seem that Eidhammer et al (2017) also included the single ice category P3 scheme into the global CAM model. I think the fact that other global models have the same single ice category scheme implemented should be mentioned in the introduction and a short discussion on the difference and similarities between the approach in this paper and the one of Eidhammer et al could be included.

Page 8, line 8. What about deposition freezing at cirrus temperatures, and competition between heterogeneous and homogeneous freezing? Is this effect included in the parameterization by Karcher and Lohmann (2002)?

Page 10, line 2. Should it be S_acc=d_qr/dt|acc instead of S_acc=d_qr/dt|aut?

Page 10, line 2: I suggest including "mass" for the ice mixing ratio: ice mass- q_i .

Page 11, line 16: Is the limit of 0C due to diagnostic rain? I suggest including the reason for the 0C (or actual 5C) limit.

Page 16, line 23. I suggest adding a comma after ". . .in the cloud"

Page 20, line 9. I suggest renaming the section 5.3 with something more descriptive, since single ice category is considered in all the other sections as well.

Page 20, line 12. Remove comma after "remember"

Page 20, line 14: I suggest reminding the readers of the 4 parameters here. Page 21, line 4: Add ". . ..the number concentration in the tail of the. . .."

Page 23, line 12. I would like to see a short description in how ECHAM6-HAM2 deals with conversion of ice to snow somewhere in the paper. According to the introduction, Morrison and Gettelman (2008) use a threshold size while, while Murakami (1990) base it on accretion and riming rates. On page 4, it is stated that conversion rates dates back to Murakami (1990), while on page 23, line 12 it is stated that the single ice category scheme removes the threshold size parameter. But does Murakami use a threshold size parameter?

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2017-164, 2017.