Atmos. Chem. Phys. Discuss., 13, C4339–C4341, 2013
www.atmos-chem-phys-discuss.net/13/C4339/2013/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Microphysical process rates and global aerosol-cloud interactions" *by* A. Gettelman et al.

Anonymous Referee #2

Received and published: 29 June 2013

This paper discusses the representation of autoconversion and accretion in a GCM and in a process model and as inferred from observations and the implications of this representation for the indirect aerosol effect. The authors show that the sensitivity of autoconversion and accretion with increasing liquid water path in the GCM is different from the process model. The sensitivity studies that were performed couldn't change the functional behaviour but could reduce the indirect aerosol effect by putting more weight on accretion and changing how the accretion is calculated. The new aspect in this study is the help of a process model and observations. The topic is relevant and I recommend the paper for publication after the following comments have been addressed.

Major comments:

p.11791, line 14: Instead of just stating that entrainment processes are important, say what they would do in this context

p. 11793, line 25: Aren't all accretion formulations just functions of q_c and q_r?

p.11794, lines 19/20: Isn't that obvious that accretion and autoconversion are the main sinks for cloud water? Why do they peak at 400 hPa in the west Pacific and continue all the way to 200 hPa? I would have thought that there should be ice only....

p.11798, line 7: why is the ratio of accretion to autoconversion largest highest up in the cloud? Shouldn't it increase downward as the rain sediments through the cloud?

p.11799, lines 5-12: What is the purpose of showing autoconversion and accretion vs. AOD? AOD is not relevant, but CCN are, and the particles that dominate CCN are not the same that dominate AOD. I suggest replacing AOD everywhere with CCN.

p.11800, lines 2/3: Why don't you limit your analysis to warm clouds so that you get no contribution from ice-phase processes?

p.11800, line 24: How are the deltas in R and CDN obtained given that all these data are from a present-day simulation?

p.11800, line 28: Please offer an explanation for the change in susceptibility with increasing LWP

p.11800, lines 6/7: What causes the minimum in susceptibility at an LWP=300 g/m2? Why has the reduced autoconversion an increased susceptibility at higher LWP?

p.11806, line 19: Again, p lease offer an explanation for the change in susceptibility with increasing LWP

p.11806, line 27/28: Why does the GCM have problems capturing the correct form of the accretion/autoconversion behaviour?

Minor comments:

ACPD

13, C4339–C4341, 2013

I suggest to always use small letters for autoconversion and accretion

p.11796, line 8: blue should be red

p.11799, line 23: delete one "that"

p.11800, line 17: 6e should be 6b

p.11820: add in the legend that the different curves are obtained from CAM5.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 11789, 2013.