

Interactive comment on “Strong sensitivity of aerosol concentrations to convective wet scavenging parameterizations in a global model” by B. Croft et al.

A. Ekman (Referee)

annica@misu.su.se

Received and published: 2 March 2012

This paper examines the sensitivity of aerosol (mass) concentrations to different assumptions/parameterizations regarding convective cloud scavenging in the global climate model ECHAM5-HAM. The authors conclude that the model treatment of aerosol scavenging by convective clouds has a large impact on aerosol concentrations (especially in the free troposphere) and the overall wet deposition. I find the study interesting and scientifically sound and the results should be of general interest to the scientific community. I have a few minor comments for the authors to consider.

Specific comments:

C351

- Abstract: It is not clear that the ‘two limiting cases’ deal with the ‘explicit aerosol uptake version’ of the model and whether one of these ‘two limiting cases’ is the one compared to the standard ECHAM5-HAM or not. I think that the authors in the abstract should (more clearly) explain that there are actually four different cases that they consider (three explicit versions of the model + the standard). In my opinion, it wouldn’t hurt to introduce the abbreviations (PF_INIT, CF_INIT, CF_PIPE and CF_ED) already in the abstract.

- Introduction: In principle the same comments as for the abstract, the authors should explain already here that they do four different simulations; one reference ECHAM5-HAM (PF_INIT), one ECHAM5-HAM with ‘standard’ explicit treatment of aerosol uptake (CF_INIT) and two limiting cases (CF_PIPE and CF_ED). You can always refer to the more detailed explanation that will follow in section 2.2.

- Introduction: Please explain which observations you will compare with and why these observations are selected.

- Model description, page 1693, line 6-7: Is the two moment microphysics scheme by Lohmann (2008) used in all simulations? I.e. also the PF_INIT? This is not clear. It would also be nice to give some more information about the two moment microphysics scheme, e.g. that it concerns both cloud droplets and ice crystals, how well the scheme deals with microphysical processes such as accretion etc.

- Model description: It would be good to state (somewhere) in the model description that the model does not consider in-cloud formation of aerosol. This is only discussed later on in section 3.2. The statement on page 1707, lines 5-9, that below-cloud scavenging is only considered in cloud-free gridboxes, should also be mentioned in the model description.

- Model description: Do the changes apply for both deep and shallow convection?

- Results: The authors only describe differences in aerosol mass concentrations, what

C352

about aerosol number concentrations? This would be interesting to see, also in relation to the changes in CDNC.

- Results: The authors include statements such as 'CF_ed 'has the closest agreement', 'all simulations are reasonable', and 'The agreement between the observations and the model is best and similar for the simulation PF_init and CF_ed', but don't give any quantitative measures to support these statements.

- Figure 2: Why do you show CF_ed as a 'reference'? Wouldn't it make more sense to show CF_init? - Figure 3: It would be interesting to see the net of the two bottom panels.

Technical comments:

Page 1689, line 25: I suggest changing 'greatly' to 'much'

Page 1690, line 24 (and in references): The reference 'Fridland (2004)' should be 'Fridlind (2004)'.

Page 1693, line 19-20: For which years are the climatological SSTs and sea ice?

Page 1694, lines 8-9: This sentence is unclear. I suggest: "Within each aerosol mode, Ri is the same for ice crystals and for cloud droplets".

Page 1694, line 23: Change "The tracers deposition..." to e.g. "The tracer deposition..."

Page 1701, line 1: Change "As well, the ..." to e.g. "In addition, the..."

Page 1701, line 7: The title of section 3.1.1 does not read very well.

Page 1701, lines 8-12: This paragraph is not necessary, it is already explained in the previous section.

Page 1704, lines 2-3: This sentence does not read very well.

Page 1704, line 5: I suggest changing 'greater' to 'higher'.

C353

Page 1708, lines 19-20: This sentence does not read very well.

Page 1709, line 1: Please specify that you mean aerosol mass concentrations.

Page 1725, Figure text: change 'colorscases' to 'color scales'.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 1687, 2012.