Response to Referee 2

We thank the referee for his/her valuable comments and suggestions. The responses to your comments are below each comment.

This study quantifies the dependence of the anthropogenic aerosol radiative effect on the values of several key cloud parameters that are often used to tune climate simulations to achieve global planetary energy balance. It finds surprising small dependence on the cloud parameters. However, it does not address the dependence on other parameters such as those governing aerosol properties and distribution (new particle formation, scavenging, emissions, mixing state, ice nucleation). The presentation needs to be more clear on this.

We added a statement saying that we only evaluated the effect of several key cloud parameters on the anthropogenic aerosol effect but not the effect of several key aerosol processes on it.

Minor Comments

1. line 4. Change "These processes are thus used as tuning parameters" to "The uncertain parameters in the representation of these processes are therefore adjusted".

Done

2. Line 17. Change "They" to "These cited studies".

Done

What does "initially" refer to? The first studies? The dawn of the industrial era? The beginning of a climate simulation?

"Initially" refers to the beginning of a climate simulation. We changed that.

3. Line 40. Should cite instead Abdul-Razzak and Ghan (2000), which is the modal parameterization, and Fountoukis &Nenes (2005), also a modal parameterization.

Done

4. Line 41. Abdul-Razzak and Ghan is also used in the GISS MATRIX model (Bauer et al., ACP 2008), SPRINTARS (Takemura et al., JGR 2005), and NICAM (Suzuki, GRL 2008). Nenes is used in GLOMAP (Pringle et al., ACP 2009) and GEOS5 (Sud et al., Annales Geophysicae 2009). There is also Ming's (JAS 2006) physically based scheme, which is used in the GFDL AM2 (Ming et al., JAS 2007) and AM3 (Salzmann et al., ACP 2010).

Most references have been added.

5. Line 46. Replace “impact on climate, they” with “impact on cloud water and hence the planetary energy balance, parameters used to represent them”.

Done

6. Line 71. Insert “the same” after “specified”.

Done

7. Line 86. Replace “became” with “become”.

Done

8. Line 92. Insert “have” before “received”.

Done

9. Lines 95-96. Make it more clear that this estimate by Pan et al. is the parametric uncertainty.

Done

10. Line 99. Replace “parameters” with “parameter”.

Done

11. Lines 103-104. How does this study differ from previous studies?

The studies by Pan et al. (1998) and Haerter et al., (2009) evaluated the parameteric uncertainty only for the direct aerosol effect and for the cloud albedo effect in response to sulfate aerosols, here we also take the fast feedbacks (Lohmann et al., 2010), such as the cloud lifetime effect and aerosol effects on mixed-phase and ice clouds, from the three major anthropogenic aerosols (sulfate, black carbon and organic carbon) into account. Pan et al. (1998) used a global-average box model while Haerter et al., (2009) used prescribed monthly mean mass mixing ratios of sulfate aerosols, which are empirically related to the cloud droplet number concentration. In this study, aerosol mass and number concentrations are calculated on-line and act as cloud condensation and ice nuclei. Thus, the estimates of the parametric uncertainty on the total anthropogenic aerosol effect in this paper are based on advanced aerosol-cloud microphysics interactions. They include the cloud lifetime effect, semi-direct effect and aerosol effects on mixed-phase and ice clouds in addition to the direct aerosol effect and the cloud albedo effect. We added that.

12. Line 130. Insert “present day” before “climatological ”.

Done

13. Line 219. I don't think reduced convective heating explains the decrease in cloud ice with increasing entrainment. Wouldn't the mechanism be reduced detrainment of condensate? This is mentioned in the next sentence. Why mention convective heating at all? Reduced convective heating won't reduce cloud ice.

You're right. The statement about convective heating has been removed.

14. Line 259. This would be a good place to discuss uncertainty due to uncertainty in parameters controlling aerosol properties and distribution, such as emissions, new particle formation, scavenging, and ice nucleation.

Good point, a discussion about these issues has been added.