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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of boundary layer particle formation on cloud droplet number and changes in cloud albedo from 1850 to 2000" *by* J. Merikanto et al.

J. Merikanto et al.

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We would like to thank Referee 3 for the valuable comments and suggestions. The referee suggests revisions to some of our arguments that were not presented clearly enough or required further explanations. We will give our replies to each comment below:

1. A) Word "relative" added.

   B) "Thus" replaced by "As a result".

   C) The sentence is replaced by the sentence suggested by the referee.

2. p. 5265, line 18, begins now with: "CDNC is controlled by the number of CCN-

   sized particles that originate from primary particle emissions or from atmospheric particle formation."

3. Changes in wildfires between 1850 and 2000 are probably the single most uncertain change in emissions. We thank the referee for suggesting further discussion on the matter.

   We added to Conclusions and Discussion: "Wildfires represent a major but uncertain component in 1850 continental primary particle emissions. Recent charcoal records suggest that global wildfire activity was much higher in 1850 than today (Marlon et al., 2008). For 1850 we have used a population-weighted average of AEROCOM estimates for years 1750 and 2000 (Dentener et al., 2006) where wildfire emissions in the high latitudes in the northern hemisphere (Europe, N. America, Russia) are higher in 1850 than in 2000 due to less fire suppression, but total emissions are lower in 1850 than in 2000 due to changes in population and land use."

4. Corrected.

5. In the comparison between observations and model predictions we say: "The CDNC values with BL particle formation are in a reasonably good agreement with observations while the mean CDNC is slightly underestimated. The model without BL particle formation clearly underestimates the mean CDNC in all cases."

   It is not clear how the slight underestimation of observed mean CDNC impacts the results. Since uncertainties in our analysis are discusses to a great detail elsewhere in the revised manuscript, we will not pursue the matter here.

6. Corrected.

7. Corrected.

8. Corrected.

9. We added: "in the southern hemisphere the relative contribution of particle formation to CDNC is greater in 2000 than 1850, probably due to assumed increase in SO_2 emissions by wildfires in Amazonian, West African and Australian regions. This result could be reversed if wildfires were more abundant in 1850 than in 2000 as suggested by Marlon et al. (2008), contrary to AEROCOM predictions (Dentener et al., 2006)."

10. The sentence is corrected to: "Overall, 1850-2000 increase in CDNC with BL particle formation shows a very different pattern than 1850-2000 increase in CDNC if BL particle formation is omitted."

11. The sentence was modified to: "It is also possible that biogenic organic species control BL particle formation (Bonn et al., 2008)."

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 5263, 2009.