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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.

Anonymous Referee #3

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This article describes the impact of including a new particle formation scheme on cloud albedo changes from 1850 to 2000. It shows that since new particle formation is already large in 1850, and since the cloud albedo change depends on the relative change to CDNC with and without the scheme, including the scheme does not have much affect on the cloud albedo change. However there are some interesting regional differences if the scheme is included. The study makes a nice contribution to understanding how aerosol microphysics affects aerosol indirect effects. There were some points that were unclear or require more explanation, as listed below. I recommend publication following the requested revisions.

1. Abstract: The results were not clear to me after reading the abstract:

a) Please add the word "relative" here: "by approximately the same relative amount in both years"

b) In the next sentence replace "Thus" with "As a result" (since this sentence may not be obvious to those not familiar with the theory).

c) I recommend changing this: "Over most modern-day polluted Northern Hemisphere regions particle formation suppresses the 1850-2000 increase in CDNC and cloud albedo." To "Over most modern-day polluted Northern Hemisphere regions, including a model particle formation scheme suppresses the 1850-2000 increase in CDNC and cloud albedo because particle formation is already large in 1850."

2. p 5265, Line 3, begin this paragraph with the point that CDNC is controlled by combination of primary particle number and nucleation amount.

3. p 5268„ Line 26 These biomass burning changes are quite large. Some recent studies suggest that biomass burning was quite substantial in the mid-1800s (e.g. Marlon et al., Nature Geoscience, 2008). In the final section, discuss the influence of the large biomass burning changes assumed here on the results.

4. P5269 Line 8 typo

5. Section 3.1, Table 1 BLPF are still underestimated by the model. Discuss the implications of this for the results.

6. p. 5270, line 16 should be Fig. 2?

7. Table 2 caption typo: corresponding

8. P5271 line 15, typo chance should be change.

9. P 5271, Line 11, Add an explanation for this result: "in the Southern Hemisphere the relative contribution of particle formation to CDNC is greater in 2000 than 1850"

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10. p 5271, this sentence is not clear: "Overall, the changes in the relative importance of particle formation to CDNC show a very different pattern than the changes in CDNC if particle formation is omitted."

11. p 5275 Please add more explanation to this sentence: "It has also been shown that biogenic organic species could control the nucleation rate (Bonn et al., 2008), which would lead to suppressed particle formation over marine regions."

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

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