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Interactive comment on "Sensitivity of global cloud condensation nuclei concentrations to primary sulfate emissions parameterizations" *by* G. Luo and F. Yu

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Manuscript Title: Sensitivity of global cloud condensation nuclei concentrations to primary sulfate emissions parameterizations

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Reply to Referees' comments

The authors thank the referee for the constructive comments which help to improve the manuscript. Our point-to-point replies to the comments are given below. The manuscript has been revised accordingly. All the changes have been highlighted in the revised manuscript using MS word "Track Changes" tool.

Reviewer Comments

P27696 (abstract): Other studies have also treated the condensation of low-volatility SOA on nucleated particles (e.g., Spracklen et al., 2006, 2008; Pierce and Adams, 2009). See also P27699 L8.

Clarified.

P27696, line 20 Change "0.2" to "0.2%".

Corrected.

P27696, Line 22-23. I think this line is misleading without clarification. It is difficult to ensure that you are comparing like-with-like studies (see comments below). For example, a reason for the lower sensitivity in earlier models simulations is that they only treated sulfate (Adams Seinfeld, 2003) or sulfate and sea-salt (Spracklen et al., 2005b).

It is not suitable to expand the discussion in the abstract. To address the referee's concern, we have deleted the sentence from the abstract and modified the text accordingly.

P27697, Line 22. I don't think this is accurate. At least Makkonen et al. (2009) did not make this assumption (see Stier et al. (2005) for a description of the assumed sizes).

Agree. We have modified the discussion to reflect this in the revised manuscript.

P27698. L3-L21. The first two studies (Adams and Seinfield, 2003; Spracklen et al., 2005b) did not include carbonaceous aerosol. It is therefore not too surprising that these 2 studies predict a much larger impact of primary sulfate on CCN (because the baseline CCN in these studies was comparatively low). The authors should state that this is the reason.

Done.

P27698, L21. It is not obvious which numbers are compared to give a factor 6. I think care has to be taken here to try and compare like-with-like studies. It would be expected that early studies that only included sulfate aerosol would calculate a much larger sensitivity to primary sulfate than later studies which included many other primary aerosol sources.

When we compared our simulated impact of FS2.5FN5 with IMN nucleation scheme on global boundary layer annual mean CCN0.2 (8%) with the impact of FS2FN15 with BHN nucleation scheme presented by Wang and Penner (2009) (53%), we got the factor of 6. To avoid ambiguity, we deleted this sentence.

Spracklen et al., GRL, (2008) is incorrect in reference list.

Corrected.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 27695, 2010.