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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Radiative forcing and climate response to projected 21st century aerosol decreases" *by* D. M. Westervelt et al.

Anonymous Referee #3

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In this study long-term trends of radiative forcing and changes in surface air temperature, precipitation, liquid water path, and cloud droplet effective radius due to the aerosol-radiation and aerosol-cloud interactions along the RCP scenarios are estimated with a general circulation model. The authors made efforts to do the long-term ensemble simulations for analyzing comprehensive aerosol effects. However, the novelty of this study is not clear in this manuscript in comparison with past similar studies shown in Table 1. If the authors can present the novelty, it should be clearly written in Abstract, Introduction, and Conclusions. For example, in the latter half the Abstract, where the novelty should be stated, the authors write "we compare recent studies to results from the present work in Sect. 5.1". Readers can make a mistake to understand that the primary purpose of this study is just the comparison with past studies.

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The author should clearly write what the lacks are in the past studies and what the novelties are in this study here. Also there are a few lacks of understanding on the aerosol-climate interaction. Therefore I suggest that the authors should make major revisions if the novelty of this study can be stated only by the revisions. Otherwise I recommend resubmission after an additional simulations and analyses of fixed emission and SST experiments (RCPx.x_F_RFP) for understanding a difference between fast and slow feedbacks on the aerosol effects, which can be a novel study. The other major comments are indicated below.

1. Page 9297, lines 5 and 15: Add “for warm rain” after “precipitation rates” and “rainfall rates”, respectively.

2. Page 9297, line 20: “we must rely on future projections or scenarios”. The RCPs are not provided under a concept whether we can trust them or not, so the authors should delete the sentence.

3. Section 2.1: Add description of aerosol transport processes other than emission briefly. Also add basic information on the ocean model because it is significant to evaluate the aerosol effects on whole climate change discussed in this manuscript.

4. Page 9310, line 4: It is interesting that the LWP is higher in RCPx.x_F than RCPx.x as shown in Fig. 4. The authors should state how aerosols contribute to increasing the LWP relative to global warming.

5. Page 9310, line 23: Revise from “cloud cover” to “LWP”.

6. Page 9316, lines 10-11: “These increases are most likely due to a feedback from the aerosol-driven temperature increase, since warmer air can hold more moisture.” This occurs all over the globe. This trend in the Arctic region is probably from melting sea ice and consequently providing a large amount of water vapor by opened ocean. The authors should confirm the temporal trend of sea ice.

7. Page 9326, lines 13-14: “liquid water path, and cloud droplet effective radius are

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strongly correlated spatially with aerosol optical depth changes". It is a matter of course because the parameterization of the aerosol-cloud interaction is treated to present this relations.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 9293, 2015.