

Interactive comment on “Separating radiative forcing by aerosol–cloud interactions and fast cloud adjustments in the ECHAM-HAMMOZ aerosol–climate model using the method of partial radiative perturbations” by Johannes Mülmenstädt et al.

Ghan (Referee)

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This study proposes to use the partial radiative perturbation method to separate contributions of changes in droplet number, liquid water content, and cloud fraction to estimates of effective radiative forcing by aerosol-cloud interactions. The method is described fairly well, except as noted. The authors present results that show conclusively that the method is not biased. The title captures the method and conclusions. The

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abstract succinctly and clearly summarizes the results. The referencing is adequate, except as noted.

page 1, line 4. Insert “by anthropogenic cloud droplet number change” after “radiative forcing”.

Page 3, lines 15-16. Consider the decomposition expressed by equations 6-8 in Ghan et al. PNAS 2016.

Page 4. I’m concerned about substituting a cloud property from one run into diagnostic radiation calculations from another run, since cloud properties vary in time. What is done when clouds at a particular time are simulated in one run but not in the other. How is the cloud property determined then? Use time mean property will work if cloud forms at least once at that point, but what if it never forms at that point in one simulation but does in the other? This issue is mentioned later: large artifacts that occur due to the decorrelated cloud property fields, and tested in the Appendix, but it does not address the question of how to specify properties of clouds not present in one simulation.

Page 6, line 7. Insert “global mean” before “forcing”.

Page 9, lines 29-32. Is PRP the most direct method? Is it more direct than the method described by Ghan et al. PNAS 2016? Why not compare the two methods? The Ghan method is simple to implement.

Figure 2 Caption has a question.

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