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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol and physical atmosphere model parameters are both important sources of uncertainty in aerosol ERF" *by* Leighton Regayre et al.

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This manuscript is a clear exposition of an important and illuminating study of the contributions of model parameter uncertainty to uncertainty in aerosol radiative forcing.

Major comment

Uncertainty in autoconversion is likely to be major source of uncertainty in both present day radiation and in ERFaci. The manuscript notes the model presently lacks the feedback of aerosol effects on precipitation back onto the aerosols themselves. This feedback can be important in driving the transition from stratiform cloud to pockets of open

celled convection. Moreover, the study does not consider the sensitivity to the representation of autoconversion itself, in particular the dependence of the autoconversion rate on droplet number. I would like to see more discussion of the impacts of these limitations on the conclusions of the study.

Minor comments.

Lines 71-72: uncertainty.

Lines 390-396. The validation of the emulators is never presented. How accurately did the emulators reproduce the simulated fields?

Lines 458-462. Won't the variance for the combined uncertainty be greater if there are no interactions? If independent don't the variances add? Couldn't negatively correlated interactions decrease the uncertainty from the neutral case, and possible produce less uncertainty than with either set of parameters?

Line 704. Make it clear this is global mean. How does this accuracy constraint compare with the accuracy of the emulator?

Lines 714-716. Why focus on the lower bound and not the range?

Lines 756. than the in the. Line 778. equifinality needs to be defined with a reference provided. Section 3.5.4. Explain why this particular region is chose.

Lines 876-877. Please expand on this. Do Johnson et al. explore aerosol optical depth as a constraint?

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