

Earth Syst. Dynam. Discuss., referee comment RC2
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Comment on esd-2022-11

Anonymous Referee #2

Referee comment on "Evaluating uncertainty in aerosol forcing of tropical precipitation shifts" by Amy H. Peace et al., Earth Syst. Dynam. Discuss.,
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The authors use a single model ensemble to estimate the uncertainty in attributing tropical precipitation shifts to aerosols. The topic of aerosol-forced ITCZ shifts has been reported on repeatedly in the literature, but the authors here show no relationship between aerosol ERF and tropical precipitation shift, and instead argue for shifts associated with volcanic eruptions and modulated by internal variability. Following exactly what the authors did in their simulations in this paper is quite difficult. I therefore recommend major revisions.

My main comment is that the simulation description/setup is extremely difficult to follow. It seems like 13 ensemble members were eventually chosen from an initial 2800 (where does the 2800 come from?). I'm not sure at all how the 47 model parameters in the PPE map into the final 13 simulations chosen. There is a mention of a filtering process and then an assessment of diversity based on ERF from aerosols, ERF due to 4xCO₂, and some other CMIP-type simulations. I feel like some kind of table or better a schematic is needed here to explicitly describe what exactly the simulations are that the authors are running.

My other main concern has to do with ensemble size. 13 member (and 4 initial condition members) do not constitute a large ensemble that can robustly estimate internal variability and uncertainty. I would like to see the authors better justify the ensemble size when work from other groups doing large ensembles (e.g. NCAR) to estimate uncertainty are using ~40 ensemble members.

Finally, how generalizable are these findings? Though the authors span a range of the parameter space of certain variables, this all occurs within a single model.