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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Local and remote mean and extreme temperature response to regional aerosol emissions reductions" *by* Daniel M. Westervelt et al.

Anonymous Referee #1

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This is a nice study. It's great to see some numbers on these effects, especially in the context of a multi-model study. This paper is clearly important, not only for its additions to the scientific literature, but also for policy at the intersection of climate and air quality, as well as for negotiations of allowable greenhouse gas emissions. The paper is also quite well written. I am recommending minor revisions.

Comments:

I really appreciate your careful attention to your statistical tests, particularly the number of degrees of freedom.

GISS ModelE has a configuration (TOMAS) that could allow you to prognostically sim-

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Discussion paper

ulate aerosol size distribution, like CESM1. It would be useful to say why you chose not to use that configuration.

In your introduction, a reference to Murphy (2013) seems relevant: https://www.nature.com/articles/ngeo1740

Section 2.3: It would be helpful to spell things out a little more when computing the ETCCDI metrics. For your baseline, did you use the entire 400-year control run? Did you throw out any of that period for spinup? For the perturbed case, did you throw out any of the 160 years or did you use the whole thing? (This sort of thing really matters for TX90p, but to some degree for the others as well.)

Page 6, lines 24-25: In light of Malavelle et al. (2018) (https://www.nature.com/articles/nature22974), it might be worth making a comment as to whether the cloud lifetime effect is actually something that should be included.

Page 6, lines 24-29: Your results bear a striking similarity to those of Seneviratne et al. (2018): https://www.nature.com/articles/s41561-017-0057-5 Your choice, but could be worth a comment?

Page 10, lines 1-3: Is there a statistical test you could use? Anything better than simply eyeballing the change?

Figure 1: The results here say some interesting things about aerosol transport. In particular, the bottom row indicates that Wang et al. (2014) (https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014JD022297) and subsequent related studies might be relevant. The point being, your discussion about common patterns of temperature change is good, but it's not necessarily the entire story.

Figure 2: I'd recommend getting rid of the red color and just leaving it white. It doesn't say much that two models agree on the sign but without statistical significance.

In Figure 4, CESM1 clearly has some different Southern Hemisphere behavior from

the other two models (which doesn't show up in Figure 5, possibly due to cancellation). Any hypotheses as to what might be going on here?

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