

The authors have made comprehensive revisions to the original manuscript. The revisions have greatly enhanced the clarity and scientific depth of the paper. I recommend accepting the manuscript with the following minor technical corrections before final publication:

Thank you for the positive evaluation of our manuscript. We greatly appreciate your acknowledgment of our comprehensive revisions and the improved clarity and scientific depth of this work. We have implemented all requested minor technical corrections. All changes are highlighted in the revised manuscript.

1. Line 82: The manuscript states, "While its role in mean precipitation is well documented". Since it is emphasized that this role is "well documented," please add relevant classical citations at the end of this sentence to support the claim.

Response: We have added relevant classical citations as suggested. Please see the revised sentence at Line 82: While its role in mean precipitation is well documented (Guo et al., 2013; 2015; Li et al., 2016; Liu et al., 2018; Westervelt et al., 2020), its impacts on extreme precipitation over Asia have rarely been quantified.

Guo, L., Highwood, E. J., Shaffrey, L. C., and Turner, A. G.: The effect of regional changes in anthropogenic aerosols on rainfall of the East Asian Summer Monsoon, *Atmos. Chem. Phys.*, 13, 1521–1534, <https://doi.org/10.5194/acp-13-1521-2013>, 2013.

Guo, L., Turner, A. G., and Highwood, E. J.: Impacts of 20th century aerosol emissions on the South Asian monsoon in the CMIP5 models, *Atmos. Chem. Phys.*, 15, 6367–6378, <https://doi.org/10.5194/acp-15-6367-2015>, 2015.

Li, Z., Lau, W. K., Ramanathan, V., Wu, G., Ding, Y., Manoj, M. G., Liu, J., Qian, Y., Li, J., Zhou, T., Fan, J., Rosenfeld, D., Ming, Y., Wang, Y., Huang, J., Wang, B., Xu, X., Lee, S. S., Cribb, M., Zhang, F., Yang, X., Takemura, T., Wang, K., Xia, X., Yin, Y., Zhang, H., Guo, J., Zhai, P. M., Sugimoto, N., Babu, S. S., and Brasseur, G. P.: Aerosol and Monsoon Climate Interactions over Asia, *Rev. Geophys.*, 54, 866–929, 2016.

Liu, L., Shawki, D., Voulgarakis, A., Kasoar, M., Samset, B. H., Myhre, G., Forster, P. M., Hodnebrog, Ø, Sillmann, J., Aalbergstjø, S. G., Boucher, O., Faluvegi, G., Iversen, T., Kirkevåg, A., Lamarque, J., Olivié, D., Richardson, T., Shindell, D. and Takemura, T.: A PDRMIP Multimodel Study on the Impacts of Regional Aerosol Forcings on Global and Regional Precipitation, *J. Climate*, 31, 4429–4447, 2018.

Westervelt, D. M., You, Y., Li, X., Ting, M., Lee, D. E., and Ming, Y.: Relative importance of greenhouse gases, sulfate, organic carbon, and black carbon aerosol for South Asian monsoon rainfall changes, *Geophys. Res. Lett.*, 47(13), e2020GL088363, 2020

2. Line 814 (Caption of Fig. 7) and subsequent figure captions: The caption uses the somewhat broad phrase "summer differences in responses". To ensure that academic

figures are entirely stand-alone and rigorous, please avoid using just the broad term "summer." Please replace this with the more precise "summer precipitation differences" and carefully check all similar figure captions to ensure the specific variables being analyzed are explicitly named.

Response: We have revised the caption of Fig. 7 as suggested, replacing “summer differences in responses” with “summer precipitation differences”. We further checked and revised the captions of Figs. 6, 9, 10, 11, 12, and 13 to explicitly name the physical variables for all “responses” and “differences”, making all figure captions self-contained.

Figure 6. Summer spatial patterns of **surface and atmospheric variable** responses to Asian SO₄ aerosol forcing for the MMM, SO₄_p1K, and SO₄_piC:...

Figure 7. Spatial patterns of summer **precipitation** differences in responses to Asian SO₄ aerosol forcing between the p1K and piC climate states for (a) PRCPTOT (%), (b) R95p (%), (c) R95d (day), and (d) R95int (%).

Figure 9. (a) Summer area-averaged responses of atmospheric energy budget terms over northern India for SO₄_p1K (blue bars) and SO₄_piC (green bars). (b-c) Summer spatial patterns of **thermodynamic responses** with changes in horizontal DSE gradients (δH_{Th_h}) for (b) SO₄_p1K and (c) SO₄_piC...

Figure 10. Summer spatial patterns of **surface and atmospheric variable** differences in the responses to Asian SO₄ aerosol forcing between the p1K and piC climate states, defined as (SO₄_p1K-p1K) -(SO₄_piC-piC): (a) Ts (K), (b) net surface SW (W m⁻²), (c) convective cloud cover (%), and (d) ω at 500 hPa (Pa s⁻¹). (e) **Summer lower tropospheric stability** ($\theta_{850}-\theta_{sf}$, where θ is potential temperature; K) differences between p1K and piC (p1K- piC)...

Figure 11. Spatial patterns of summer **precipitation** responses in (a, b, g, h) PRCPTOT and (d, e, j, k) R95p (%) to Asian SO₄ aerosol forcing [e.g., (ARI_p1K – p1K)/p1K, expressed as a percentage], and (c, f, i, l) **precipitation response differences** between the p1K and piC climate states [e.g., (ARI_p1K-p1K)/p1K-(ARI_piC-piC)/piC]. (a, d) ARI_p1K; (b, e) ARI_piC; (c, f) **precipitation response differences** between (ARI_p1K-p1K)/p1K and (ARI_piC-piC)/piC. (g, j) ACI_p1K; (h, k) ACI_piC; (i, l) **precipitation response differences** between (ACI_p1K-p1K)/p1K and (ACI_piC-piC)/piC...

Figure 12. Spatial patterns of summer **meteorological variable** differences between p1K and piC (p1K- piC) for (a) convective cloud cover (%) and (b) surface specific humidity (g/kg). (c) **Net surface shortwave radiation (SW) response differences** to Asian SO₄ aerosol forcing between the two climate states (SO₄_p1K – p1K) – (SO₄_piC – piC) (W/m²)...

Figure 13. Spatial patterns of summer R95p responses to Asian SO₄ aerosol forcing for the piC (top) and p1K (bottom) climate states: (a, d) sum of **R95p** responses from the

individual ARI_only and ACI_only simulations, (b, e) R95p responses from the combined ARI+ACI simulation, and (c, f) R95p response differences between the two [(b, e) minus (a, d)], quantifying the nonlinearity...