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Impact of Asian aerosols on the summer monsoon strongly modulated by regional precipitation biases

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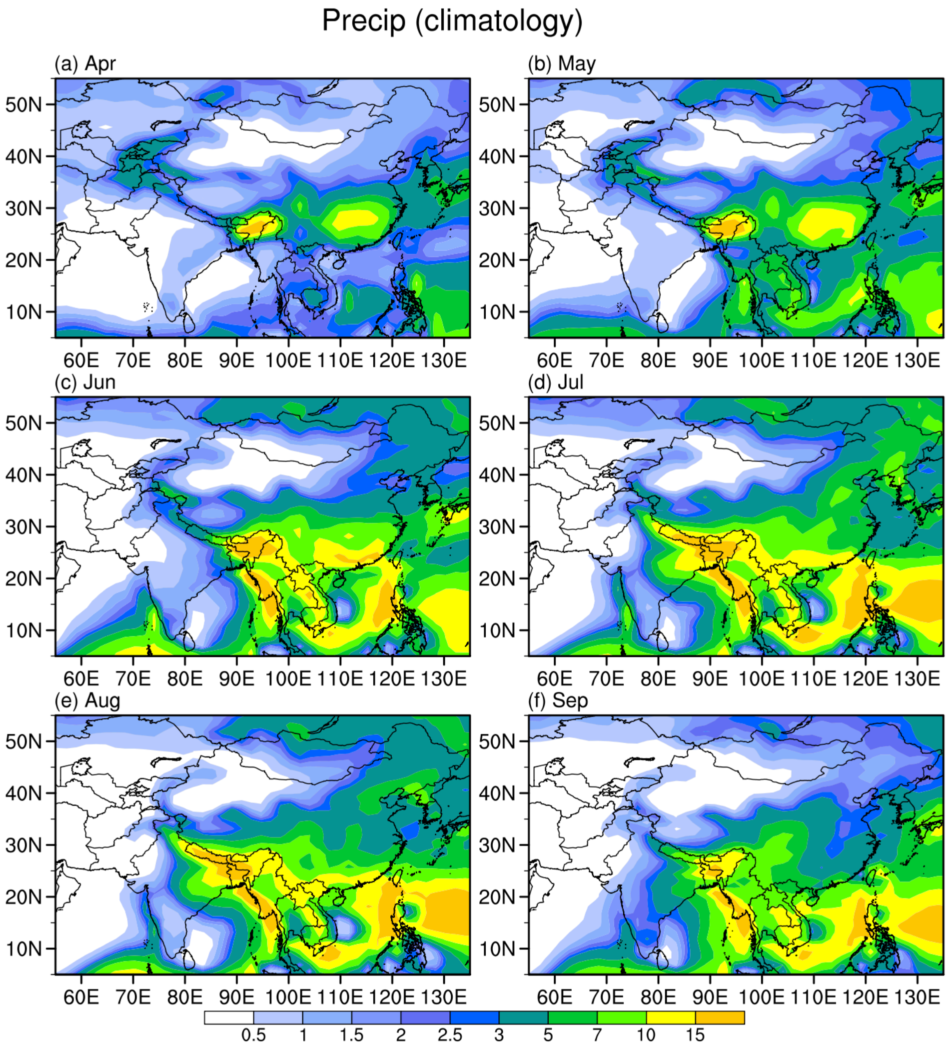

Fig. S1. CONT climatological (1993–2012 average) precipitation (mm day^{-1}) in (a) April, (b) May, (c) June, (d) July, (e) August, and (f) September.

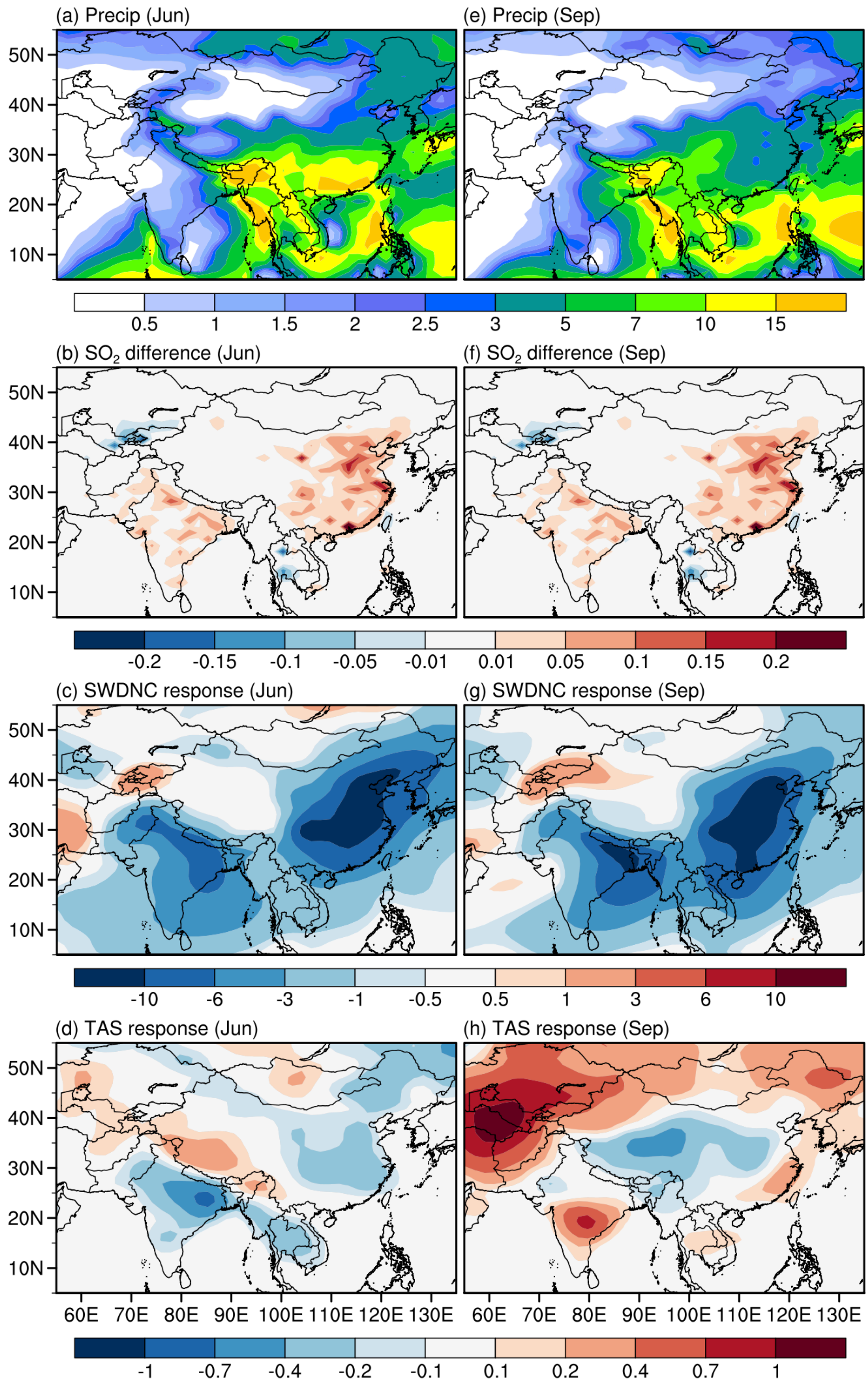

Fig. S2. (a) The June climatological precipitation (mm day^{-1}) in CONT. June differences in (b) SO_2 emissions (Tg yr^{-1}), (c) clear-sky downward shortwave radiation (W m^{-2}), and (d) near-surface temperature (K) between CONT and CONTfA. (e–h) Same as (a–d) but for September.

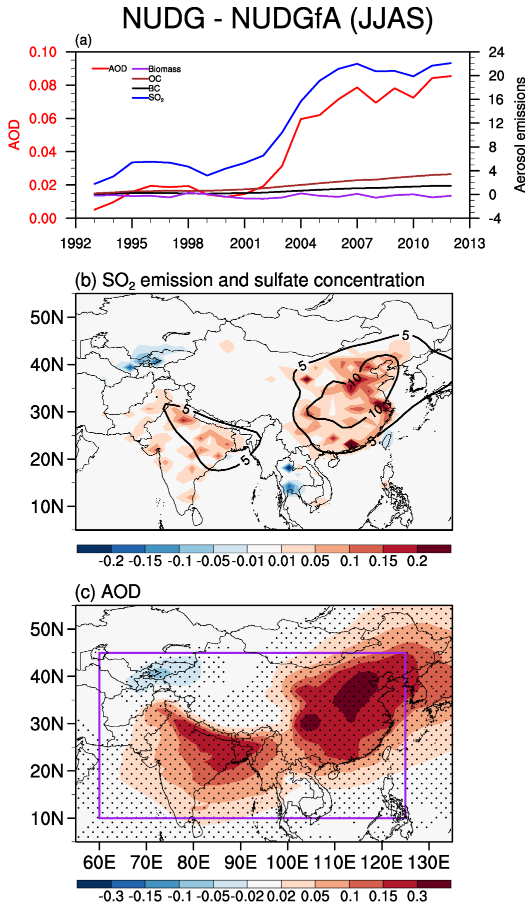

Fig. S3. Same as **Error! Reference source not found.** but for the differences between NUDG and NUDGfA.

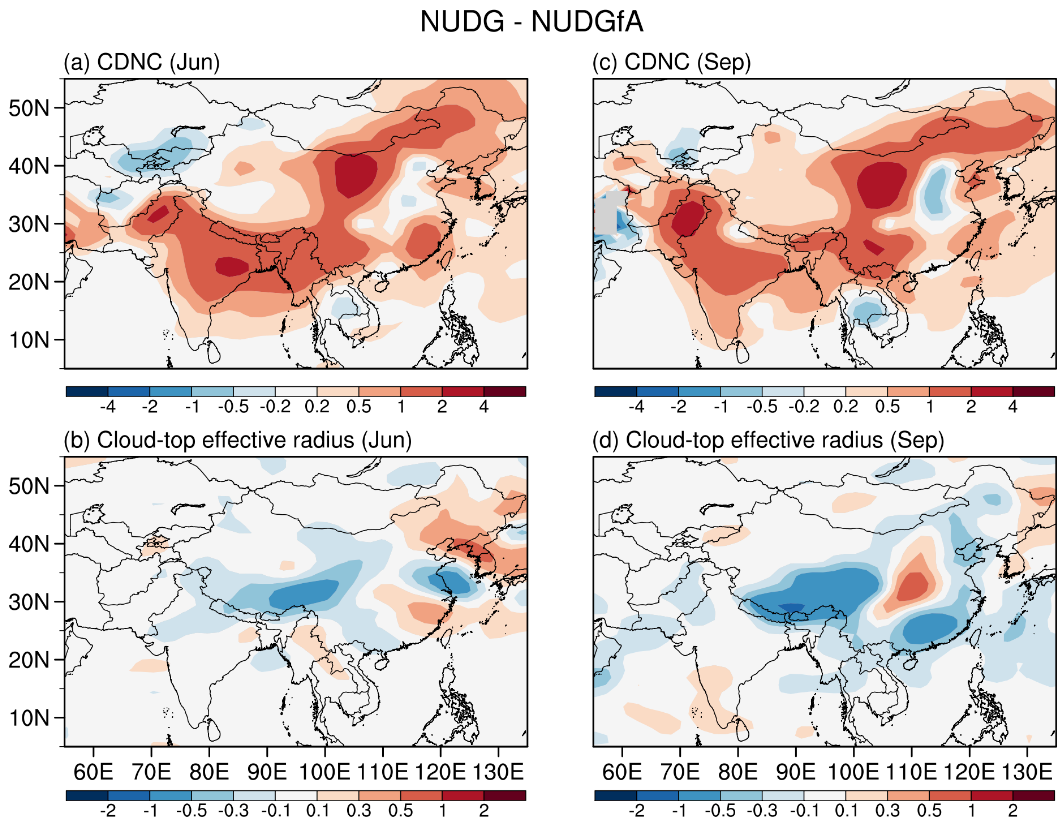

Fig. S4. June differences in (a) cloud droplet number concentration (10^{10} m^{-2}) and (b) cloud-top effective radius (μm) between NUDG and NUDGfA. (c, d) Same as (a, b) but for September.

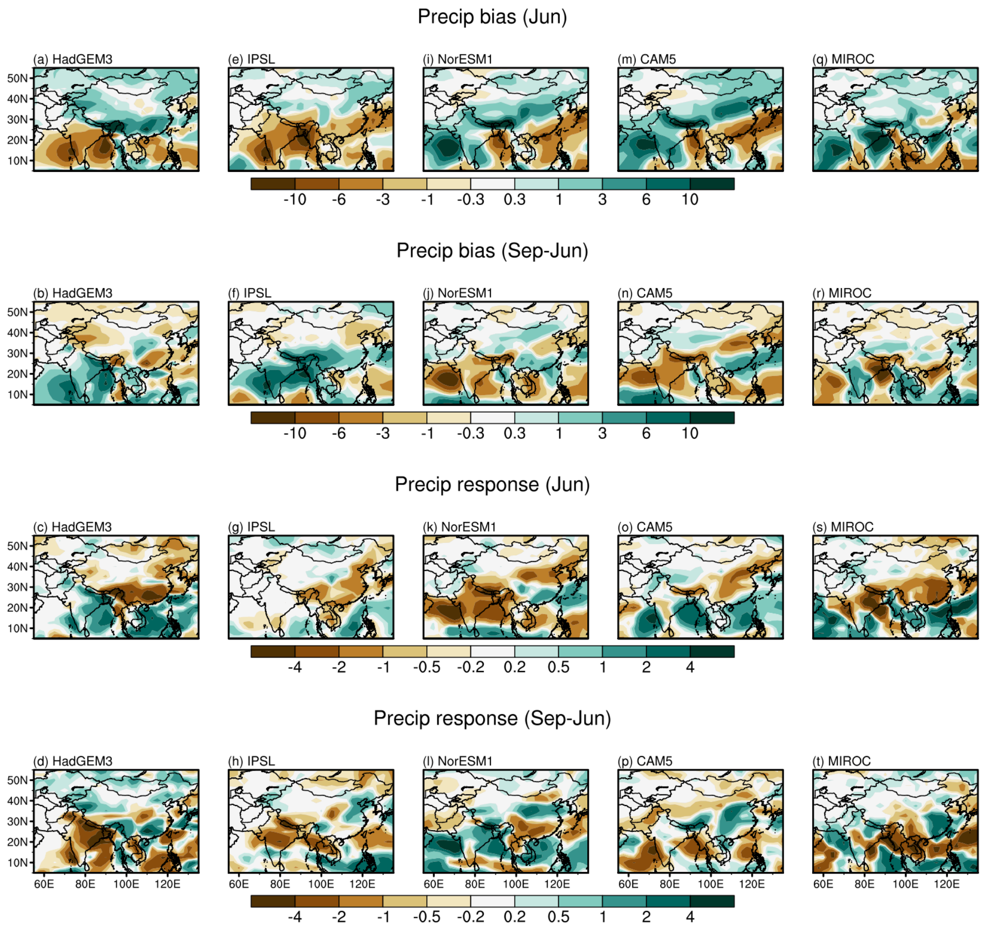

Fig. S5. From top to bottom: June precipitation bias (mm day^{-1}), September minus June difference in precipitation bias (mm day^{-1}), June precipitation response (mm day^{-1}) to increased Asian sulfate aerosols (differences in June between 10× sulfate and baseline simulations), and September minus June difference in the precipitation response to increase Asian sulfate aerosols in individual PRDMIP fixed SST models (from left to right: HadGEM3, IPSL, NorESM1, CAM5, and MIROC, respectively).

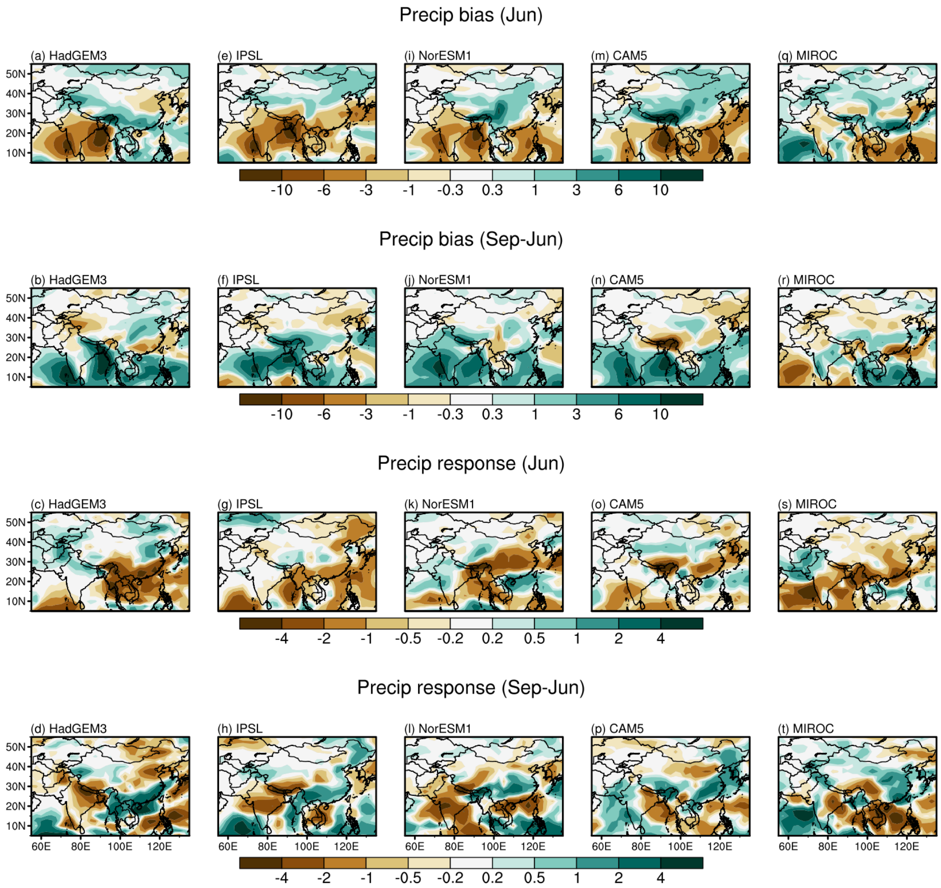

Fig. S6. As Fig. S5 but for the PDRMIP coupled models.

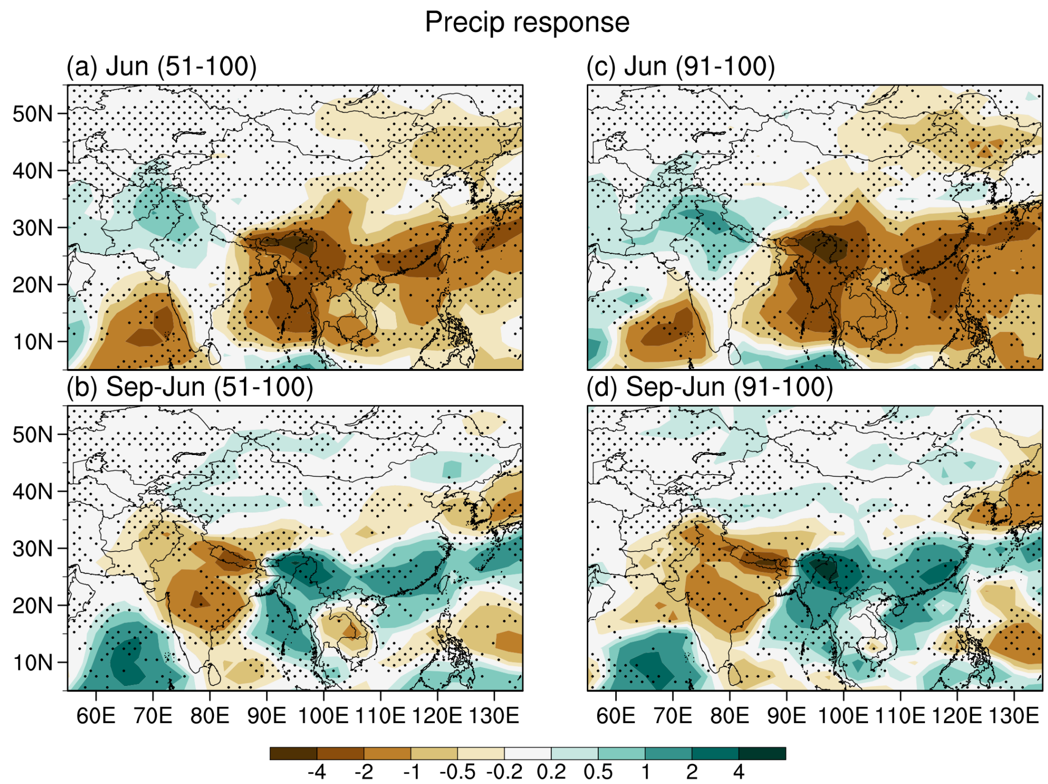

Fig. S7. PDRMIP coupled model composites in (a) June precipitation response (mm day^{-1}), and (b) the September minus June precipitation response to increased Asian sulfate aerosols (i.e., the difference between 10× sulfate and baseline simulations) averaged over the years 51–100. (c) and (d): Same as (a) and (b) but for averages over the years 91–100. Black dots mark grid-points for which at least four out of the five models agree on the sign of the precipitation differences.

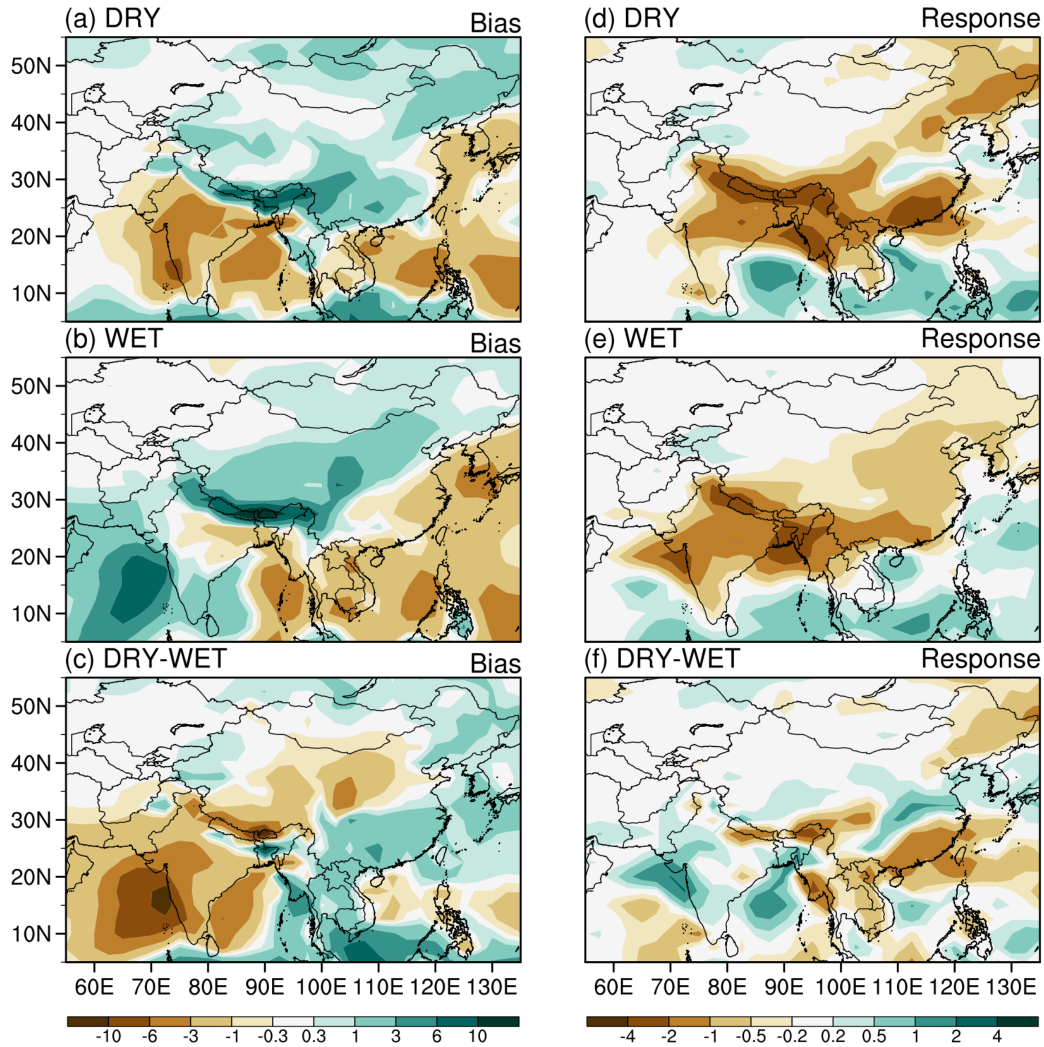

Fig. S8. Left column: Summer (JJAS) precipitation bias (mm day^{-1}) in the (a) DRY PDRMIP model composite, (b) WET model composite, and (c) difference between DRY and WET models. (d–f) Same as (a–c) but for the precipitation response to increased Asian sulfate aerosols.