Supplementary Material

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"South Asian Monsoon Response to Regional Aerosol Emission Reductions: Insights from RAMIP"

This supplementary material contains two appendix figures supporting the model evaluation described in Section 3 of the main manuscript: Figure A1 shows the annual cycle of all-India precipitation for all ten RAMIP models compared against four observational datasets, and Figure A2 shows the root-mean-square error (RMSE) analysis. Both figures informed the model selection described in Section 3.2.

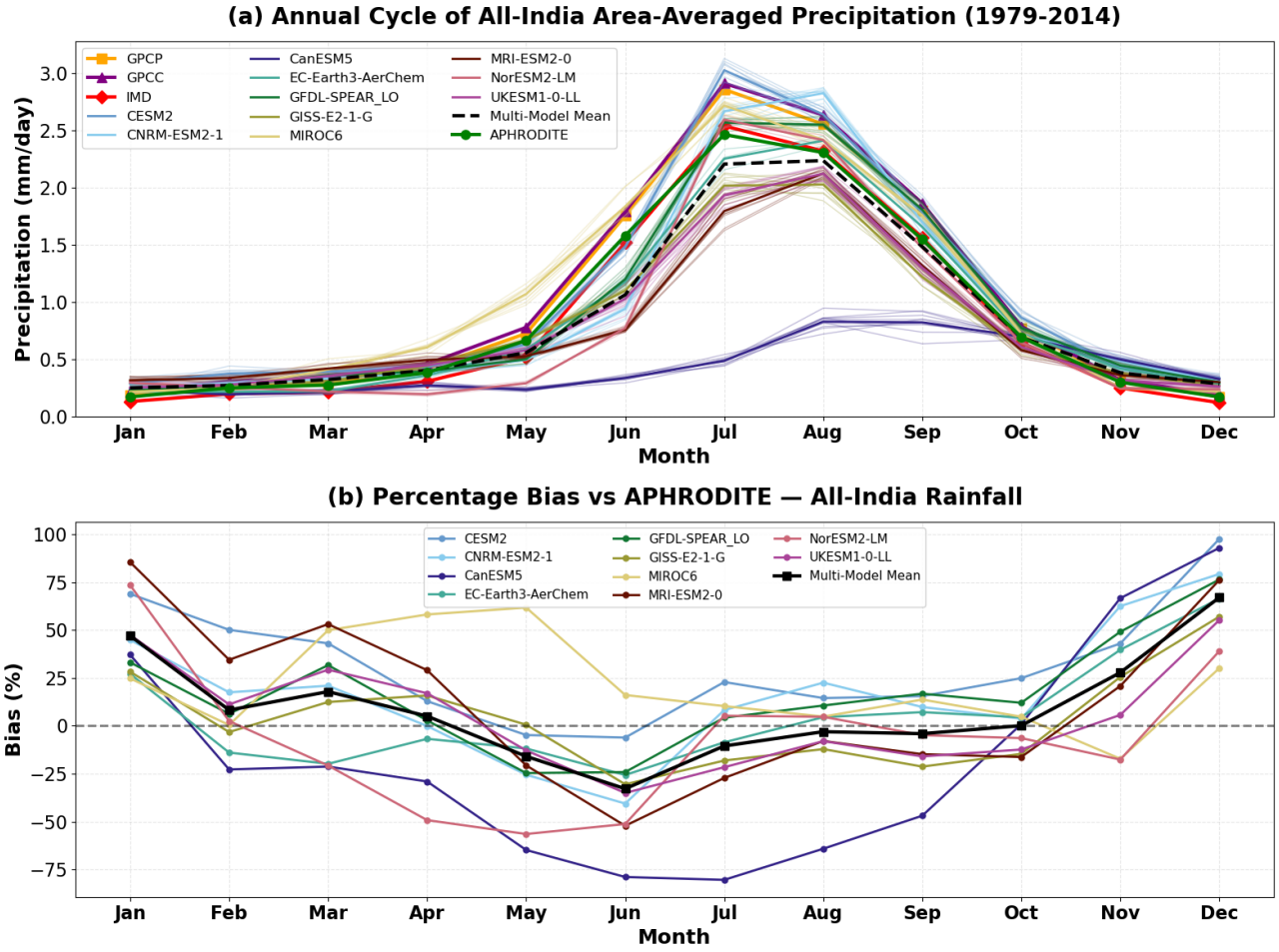

Figure A1. Annual cycle of all-India precipitation (1979–2014). (a) Monthly mean precipitation for observations (APHRODITE, GPCP, GPCC, IMD) and 10 CMIP6 models. Thin transparent lines show individual ensemble members; thick coloured lines show ensemble means. The black dashed line is the multi-model mean (MMM). (b) Percentage bias of each model and MMM relative to APHRODITE. Most models reproduce the sharp May–June monsoon onset and the July precipitation peak, though with varying biases in magnitude and timing. CanESM5-1 and GISS-E2-1-G show substantially weaker and distorted seasonal cycles, providing additional support for their exclusion from the primary multi-model mean analysis.

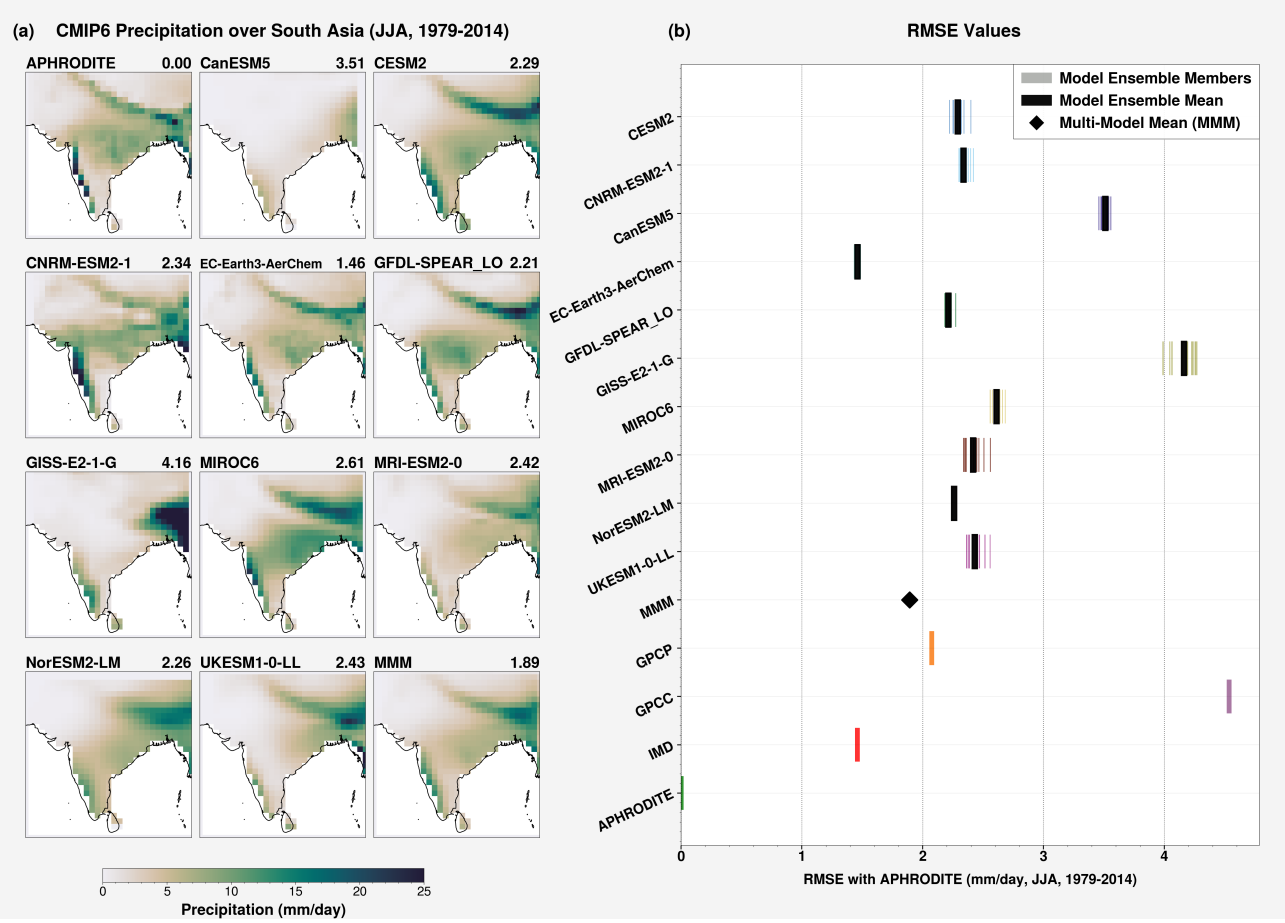

Figure A2. Root-mean-square error (RMSE) analysis of June–July–August (JJA) precipitation (1979–2014) over India (65–95°E, 5–35°N). (a) Spatial patterns of precipitation (mm day^{-1}) from APHRODITE observations and RAMIP models. Numbers in the top right of each panel show RMSE values (mm day^{-1}) with respect to APHRODITE. (b) RMSE values for model ensemble members (coloured lines for each model) and ensemble means (black lines). CanESM5-1 (RMSE = 3.51 mm day^{-1}) and GISS-E2-1-G (RMSE = 4.16 mm day^{-1}) are separated from the remaining eight models (RMSE = 1.46–2.61 mm day^{-1}) by a clear gap, complementing the pattern correlation analysis in Figure 1 of the main manuscript.