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How well do the CMIP6 models simulate dust aerosols?

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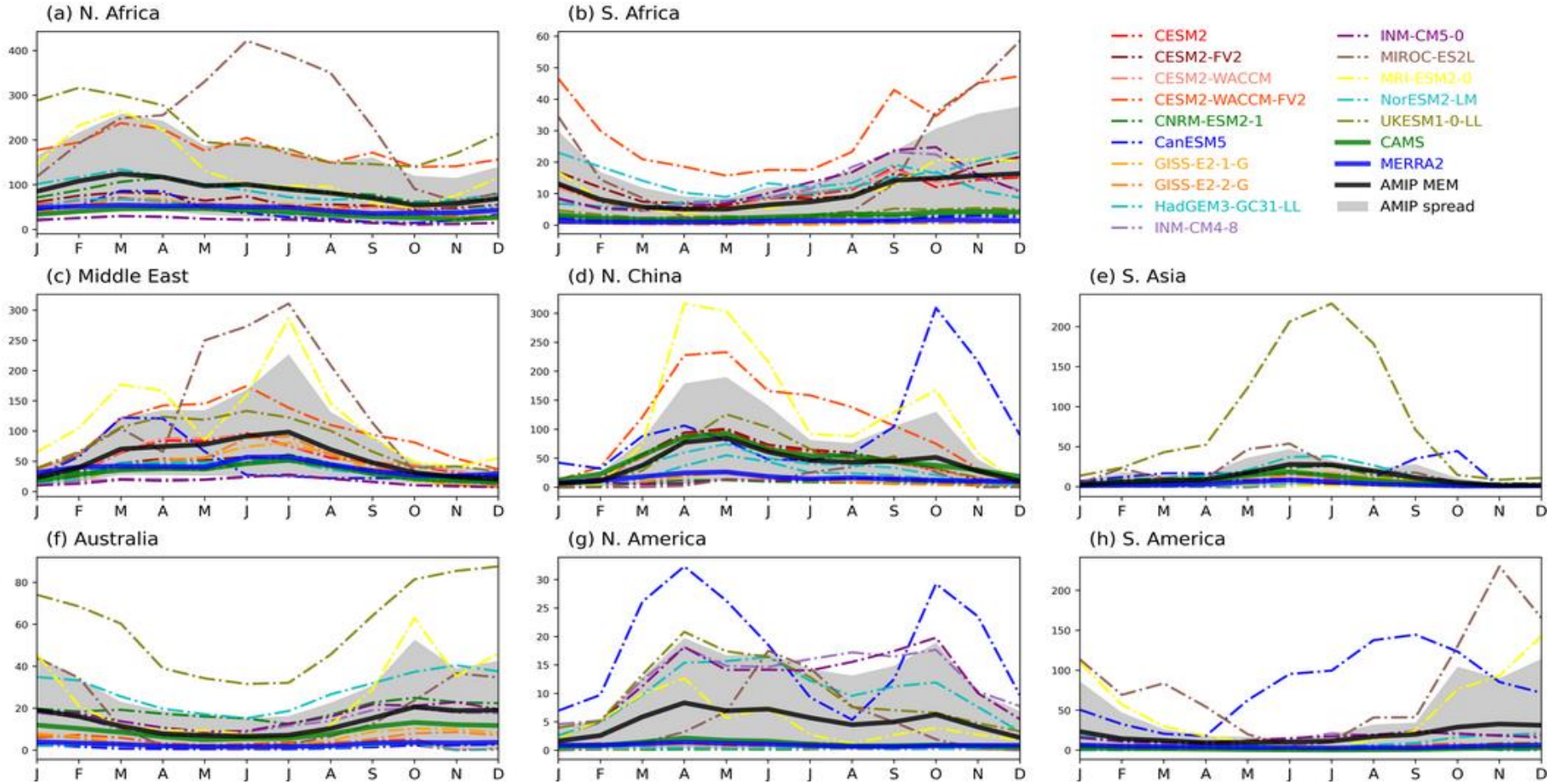

Figure S1: Seasonal cycles of the 2005-2014 mean dust emissions (g m^{-2} yr^{-1}) over the eight major source regions. Dashed curves are for each individual model, while the AMIP MEM is shown in black solid, and the 10^{th}- 90^{th} percentiles of the multi-model spreads is shown in grey shadings. also shown are those for CAMS (green) and MERRA2 (blue) reanalysis.

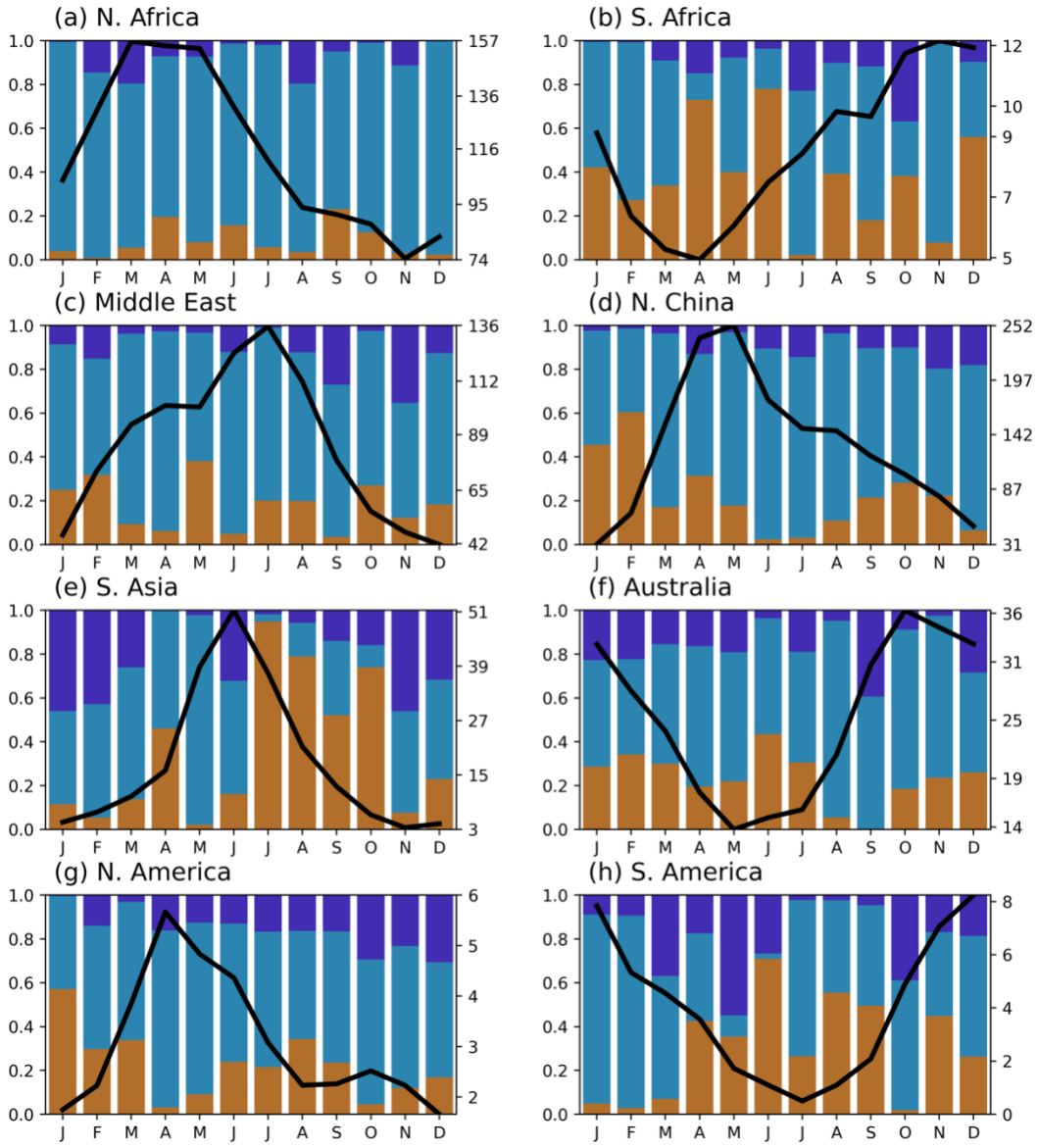

Figure S2 Normalised relative importance (left axis) of the three major dust emission drivers throughout the year over the eight major source regions in CAMS. Purple for precipitation, blue for surface wind speed, and brown for bare soil fraction. The black curves CAMS seasonal cycles of dust emissions (right axis; mg m^{-2} day^{-1}).

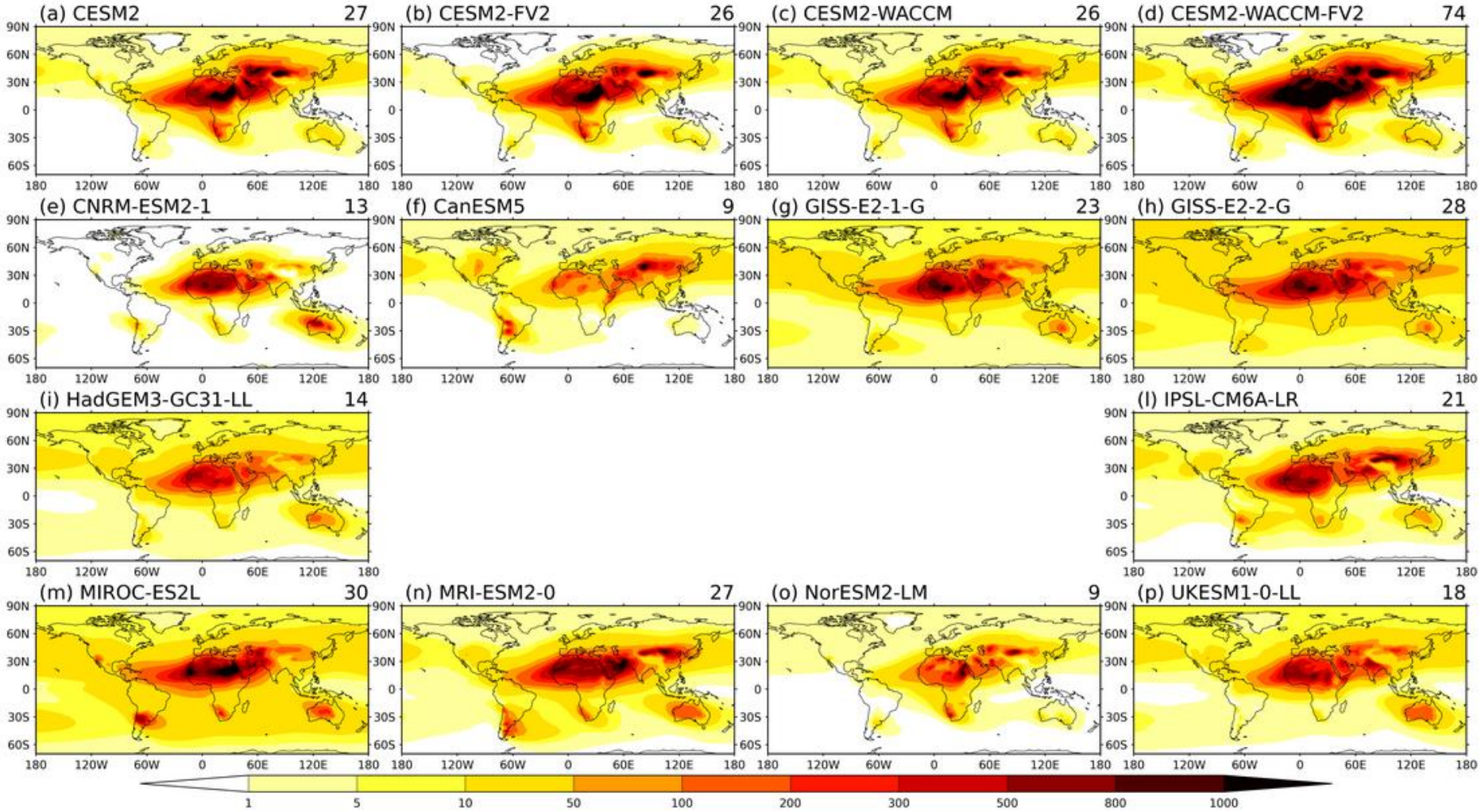

Figure S3: The CMIP6 AMIP model-simulated global annual mean (2005-2014) dust mass loading (mg m^{-2}) climatology. The numbers on the top right of each panel denote the global total dust mass burdens (Tg).

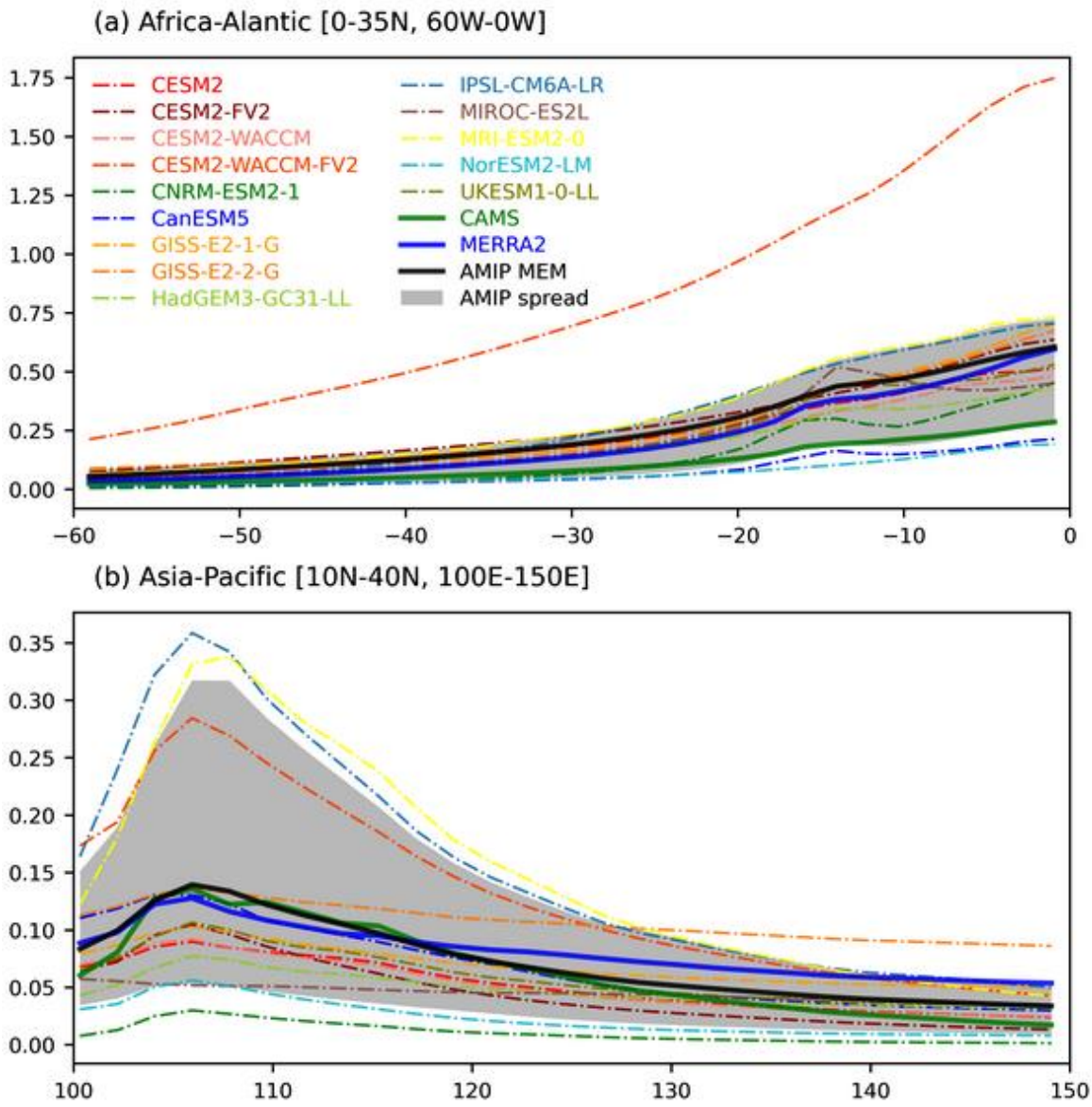

Figure S4: Meridionally averaged annual-mean dust mass loading (kg m^{-2}) over (a) the Africa-Atlantic region and (b) the Asia-Pacific region.

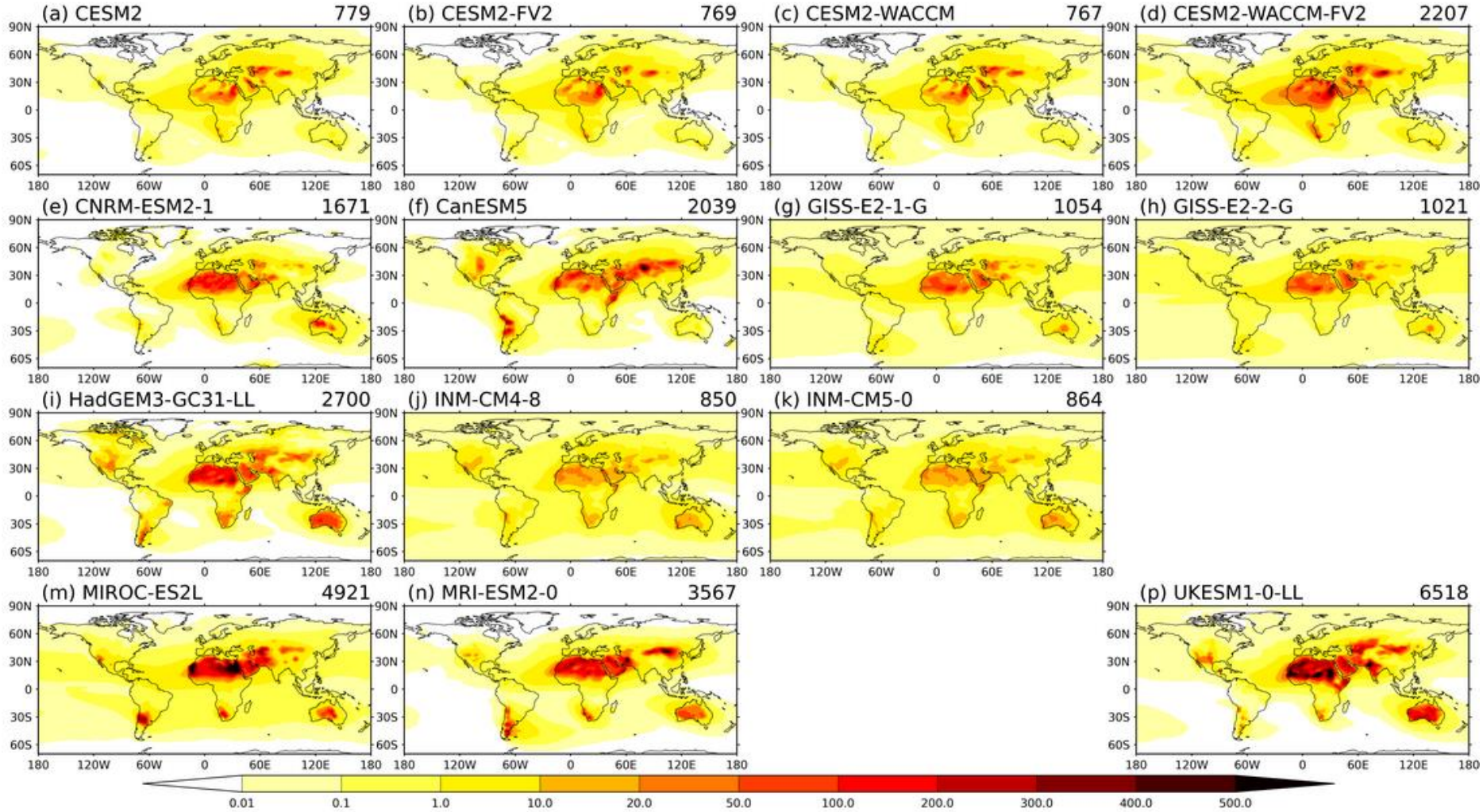

Figure S5: The CMIP6 AMIP model-simulated global annual mean (2005-2014) dry dust deposition fluxes (g m^{-2} yr^{-1}). The numbers on the top right of each panel denote the global total dry dust deposition (Tg y^{r-1}).

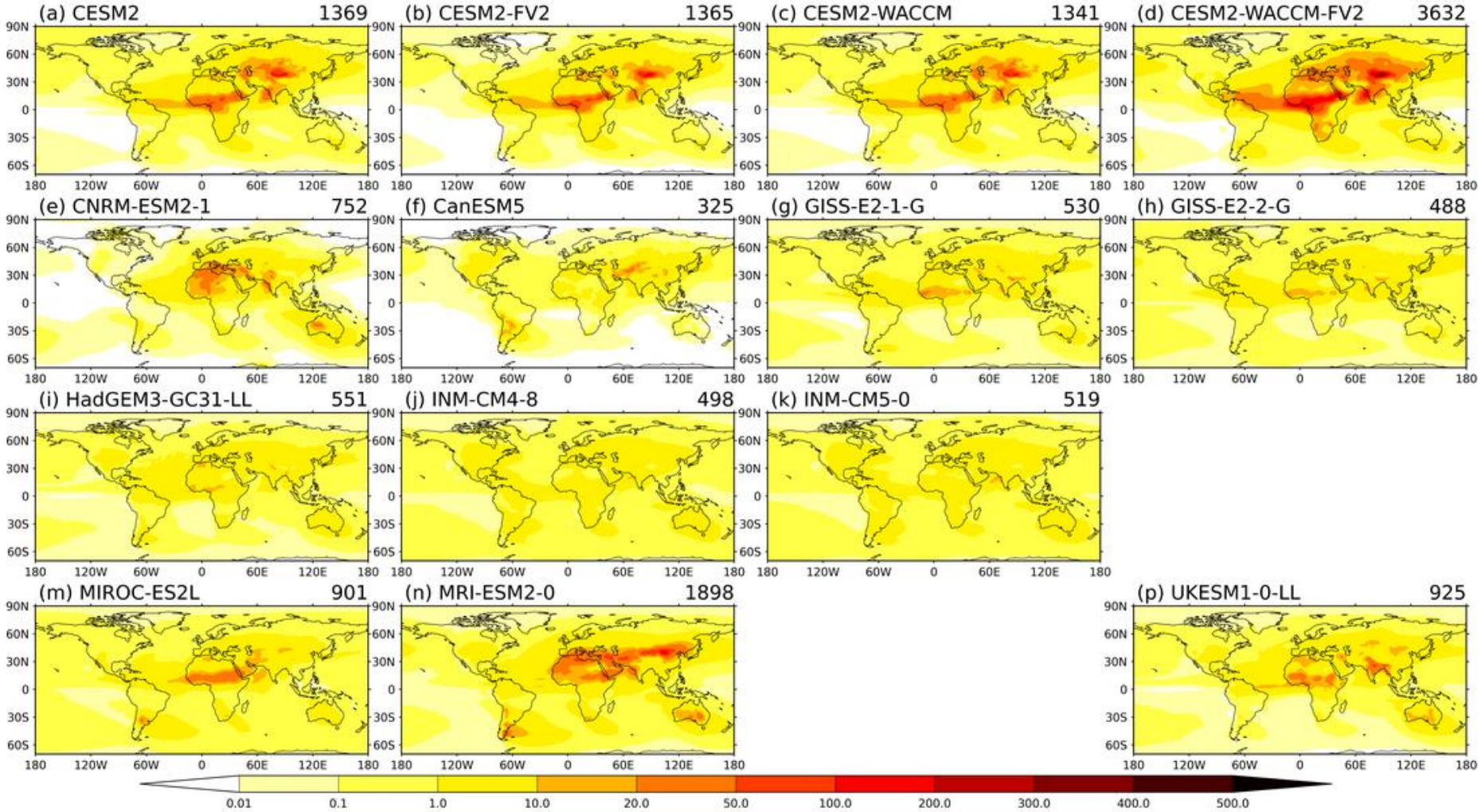

Figure S6: The CMIP6 AMIP model-simulated global annual mean (2005-2014) wet dust deposition fluxes (g m^{-2} yr^{-1}). The numbers on the top right of each panel denote the global total wet dust deposition fluxes (Tg yr^{-1}).

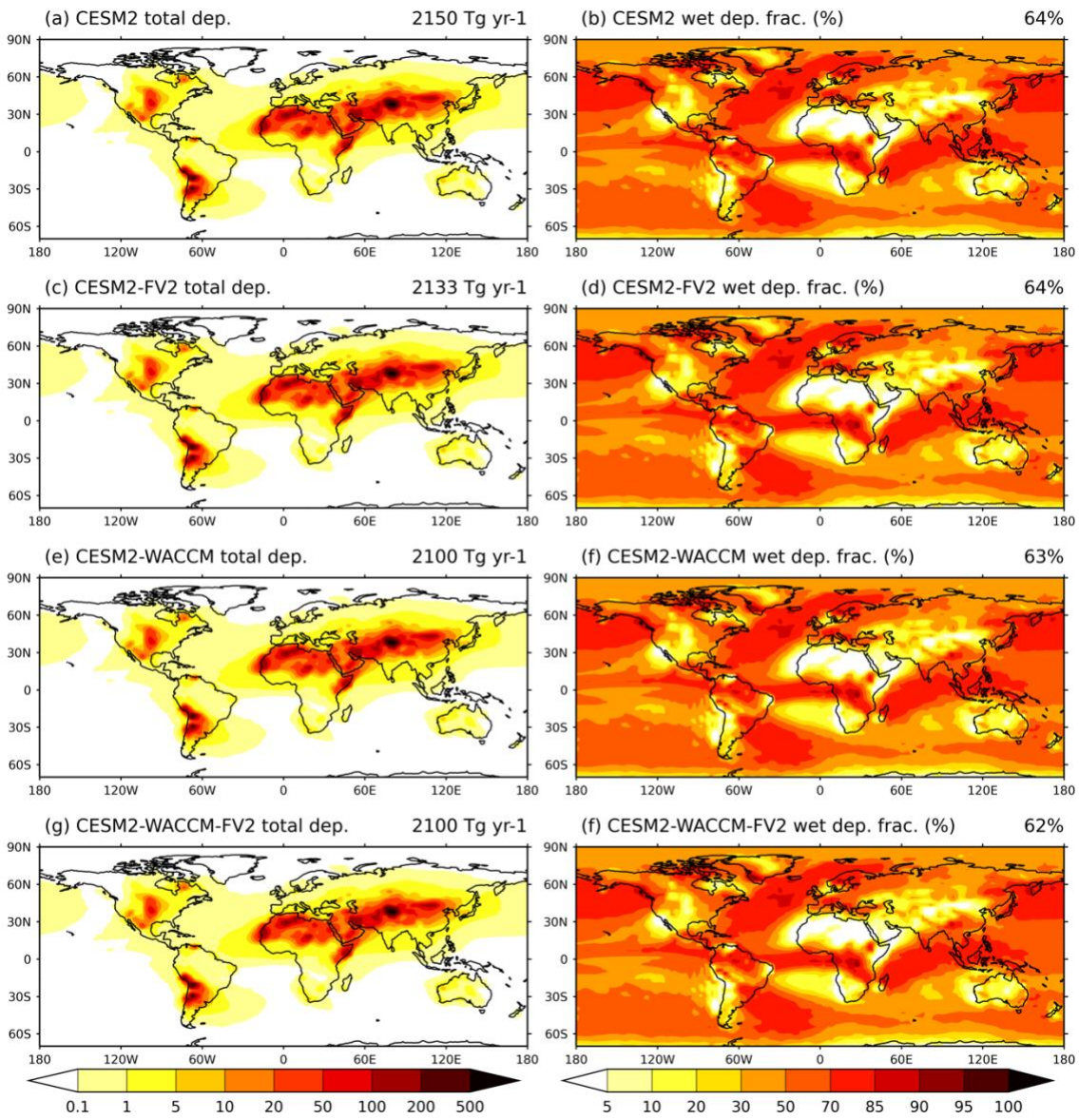

Figure S7: Comparisons of 2005-2014 mean of annual total (dry + wet) dust deposition (left; g m^{-2} yr^{-1}) and the ratio of wet-to-total depositions (right; %) in the CESM2 family models. The numbers on the top right of each panel denote the global total dust deposition flux (Tg yr^{-1}) and the fraction of global wet-to-total dust depositions (%).

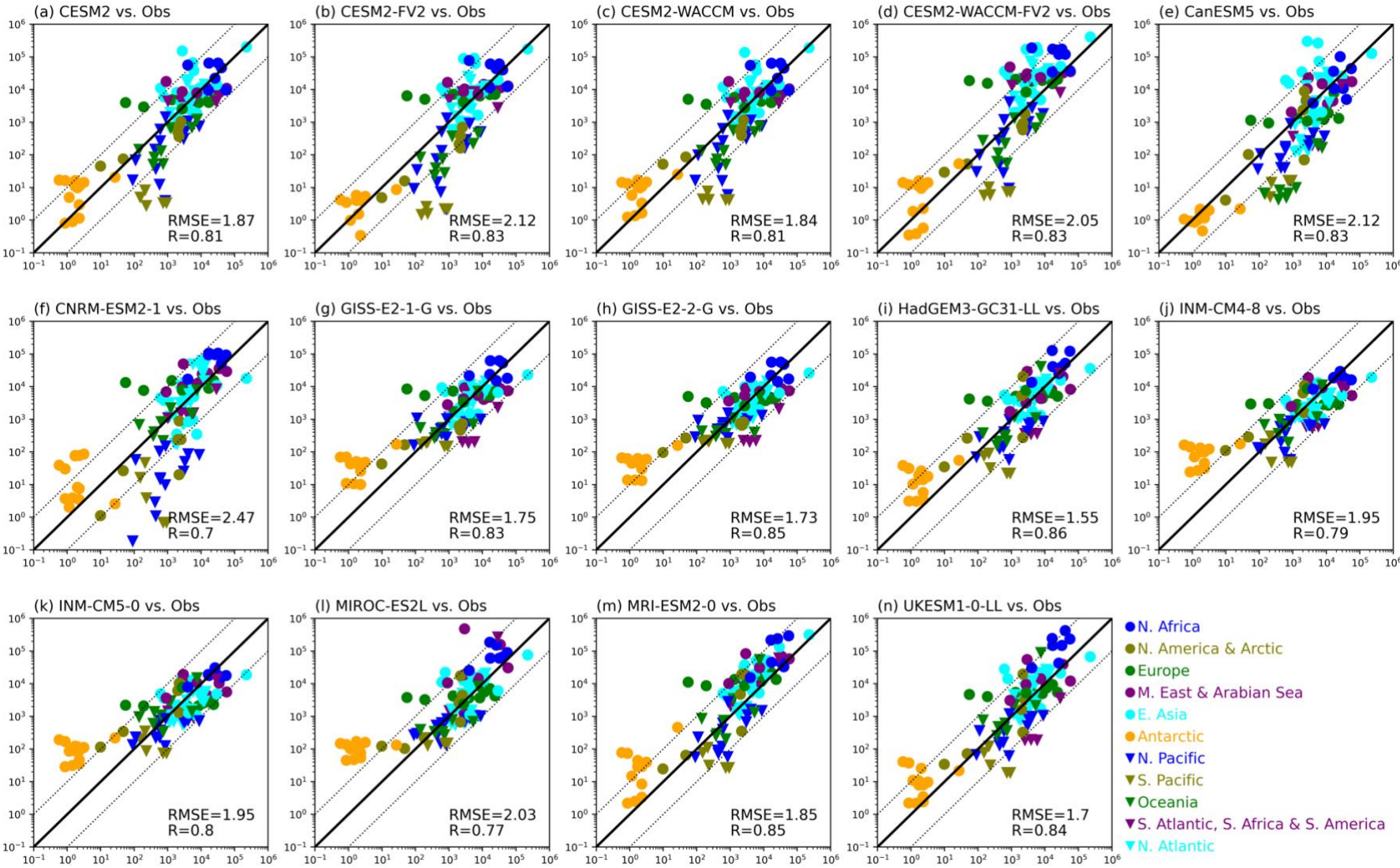

Figure S8: Scatterplots of annual mean total dust deposition flux at ground stations between individual models and observations. The stations are marked with different styles and colours for different locations (cf. Figure 1). The correlation coefficients and root mean square errors (RMSE) are calculated in log space. The 1:1 (solid) and 1:10/10:1 (dotted) lines are plotted for reference.

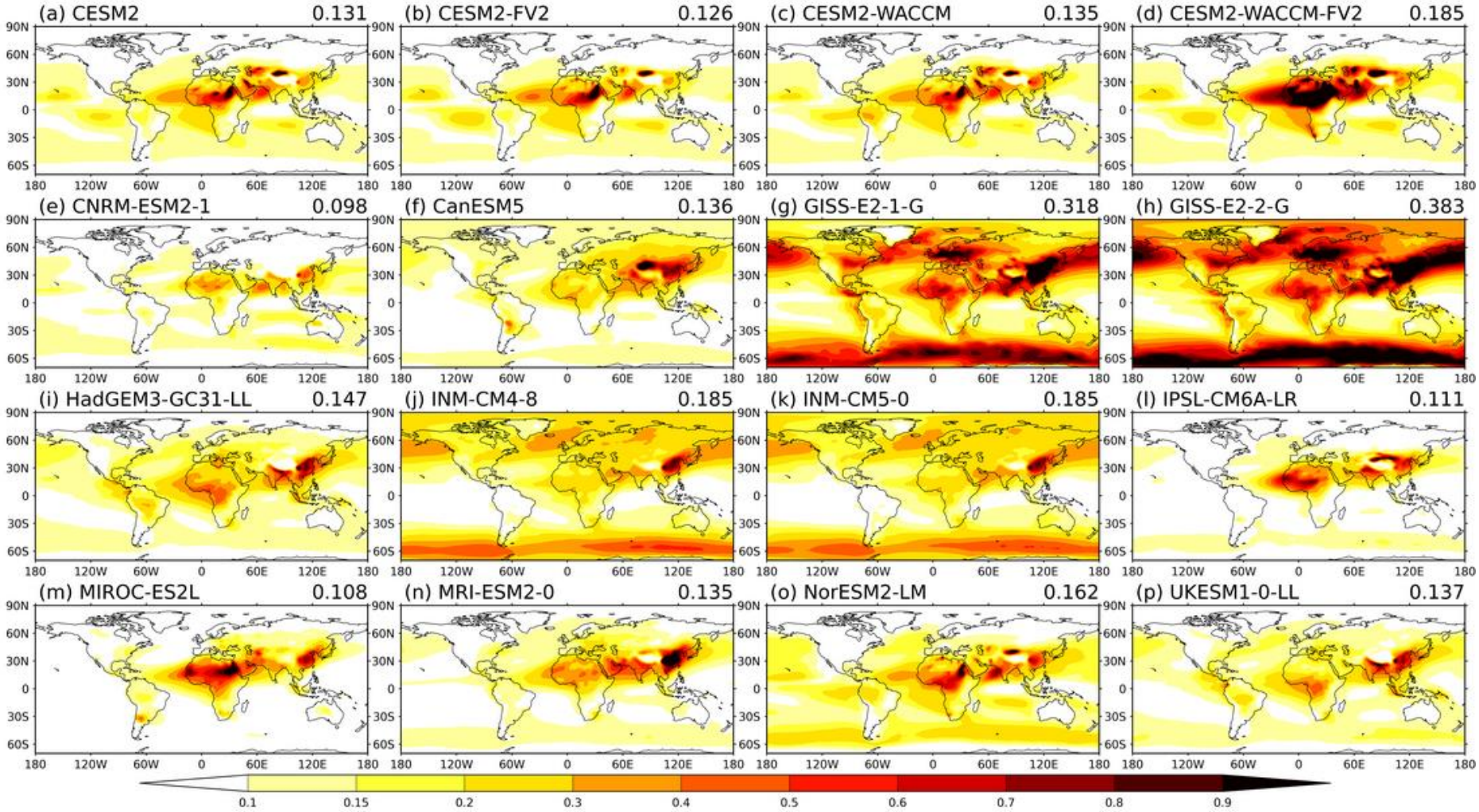

Figure S9: The CMIP6 AMIP models' simulated global annual mean (2005-2014) AOD climatology. The numbers on the top right of each panel denote the global means.

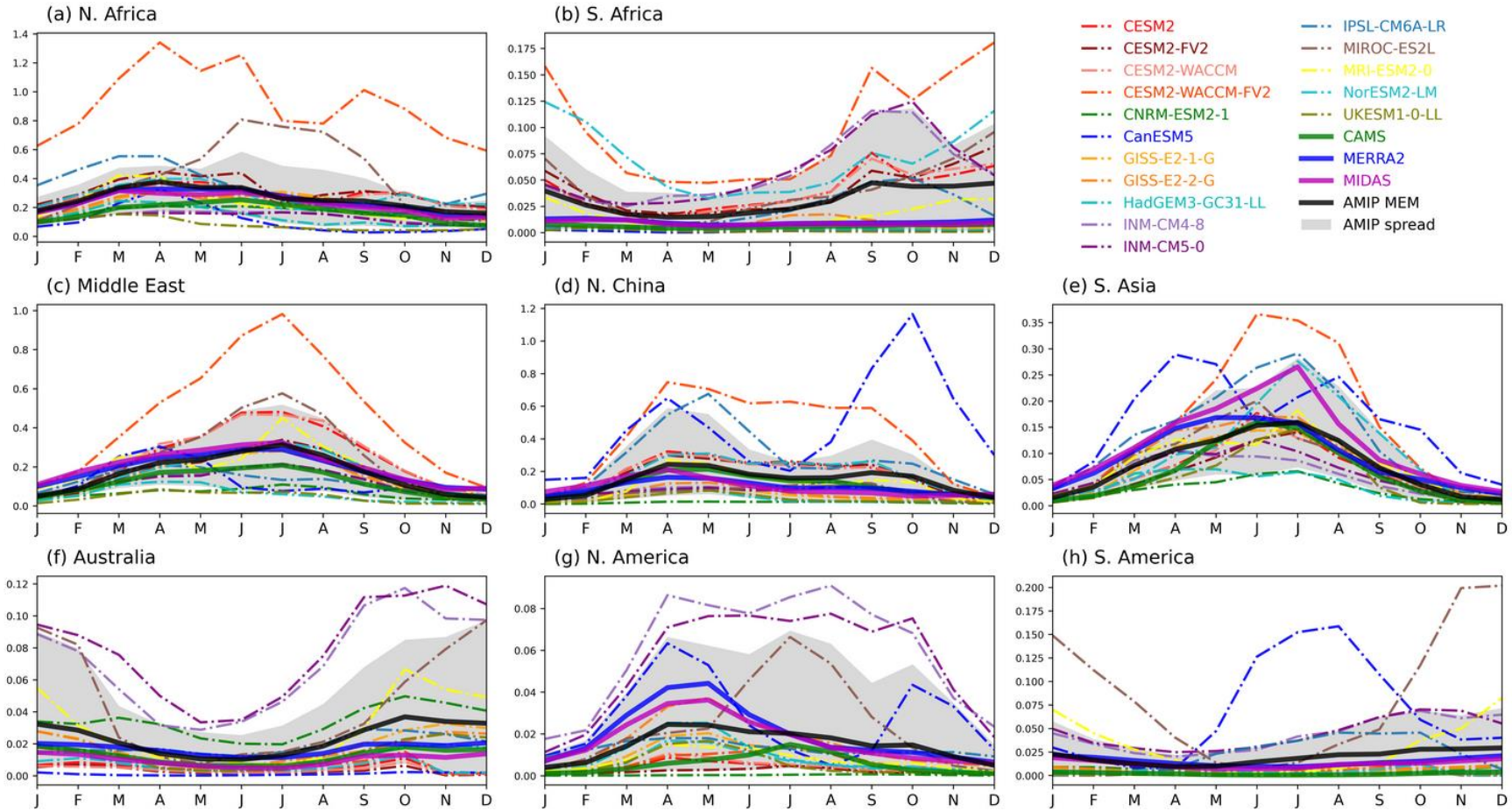

Figure S10: Seasonal cycles of the 2005-2014 mean DOD over the eight major dust source regions. Dashed curves are for each individual model, while the AMIP MEM is shown in black solid, and the 10th- 90th percentiles of the multi-model spreads is shown in grey shadings. Also shown are those for MIDAS (solid purple), CAMS (solid green) and MERRA2 (solid blue) reanalysis.