Geophysical Research Letters

Supporting Information for

Scenario and Model Dependence of Strategic Solar Climate Intervention in CESM

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Introduction

These supporting figures provide further insight into the radiative responses in unmitigated warming scenarios in CESM1-WACCM5-RCP85 and CESM2-WACCM6-SSP585, the CESM1-LE and CESM2-LE, CESM2-RCP85, and the target geoengineered climate state in GLENS-SAI and ARISE-SAI-1.5. They also document rapid adjustments to CO_2 of clouds and radiation in CESM1 and CESM2 based on idealized 4xCO2AMIP and abrupt4xCO2 coupled simulations differences with AMIP and pre-industrial control simulations (see Table 1 of the main text). These figures thus provide key context for the interpretation of SAI uncertainties provided in the main text discussion.

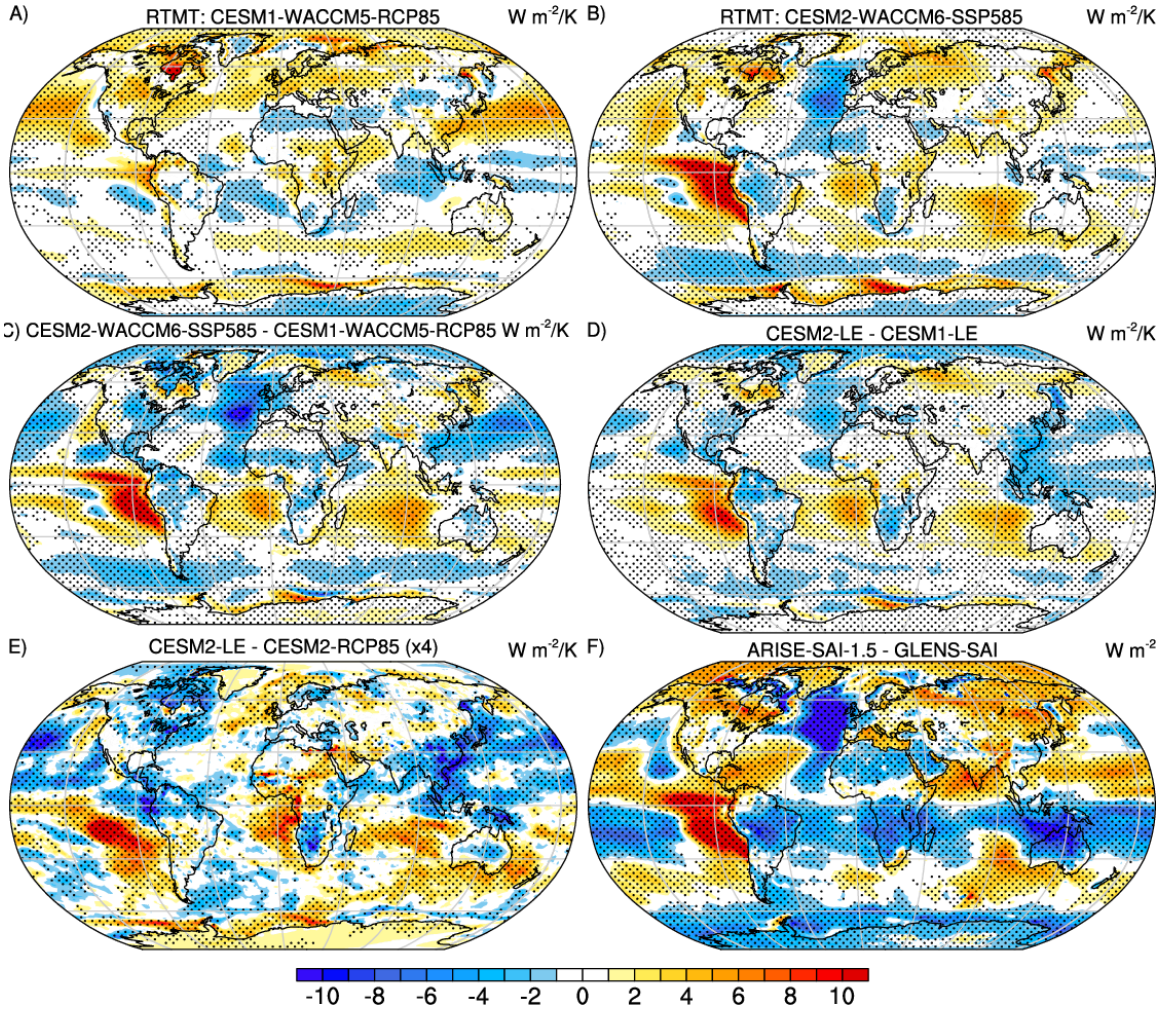

Figure S1. Normalized response in net top-of-atmosphere radiative flux (RTMT) estimated from the change between 2020-39 and 2050-69 per degree global warming for unmitigated (a) CESM1-WACCM5-RCP85 and (b) CESM2-WACCM6-SSP585 simulations, and (c) their difference (b-a). Also shown is (d) the analogous difference for the CESM1-LE and CESM2-LE and (e) the CESM2-RCP85 and CESM2-LE (scaled by 4). The difference between the geoengineered climate states in ARISE-SAI-1.5 and GLENS-SAI is shown in (f). Units for all panels are W m^{-2} K^{-1}, except in (f) where units are W m^{-2}, and stippled regions indicate differences that exceed twice the ensemble standard error.

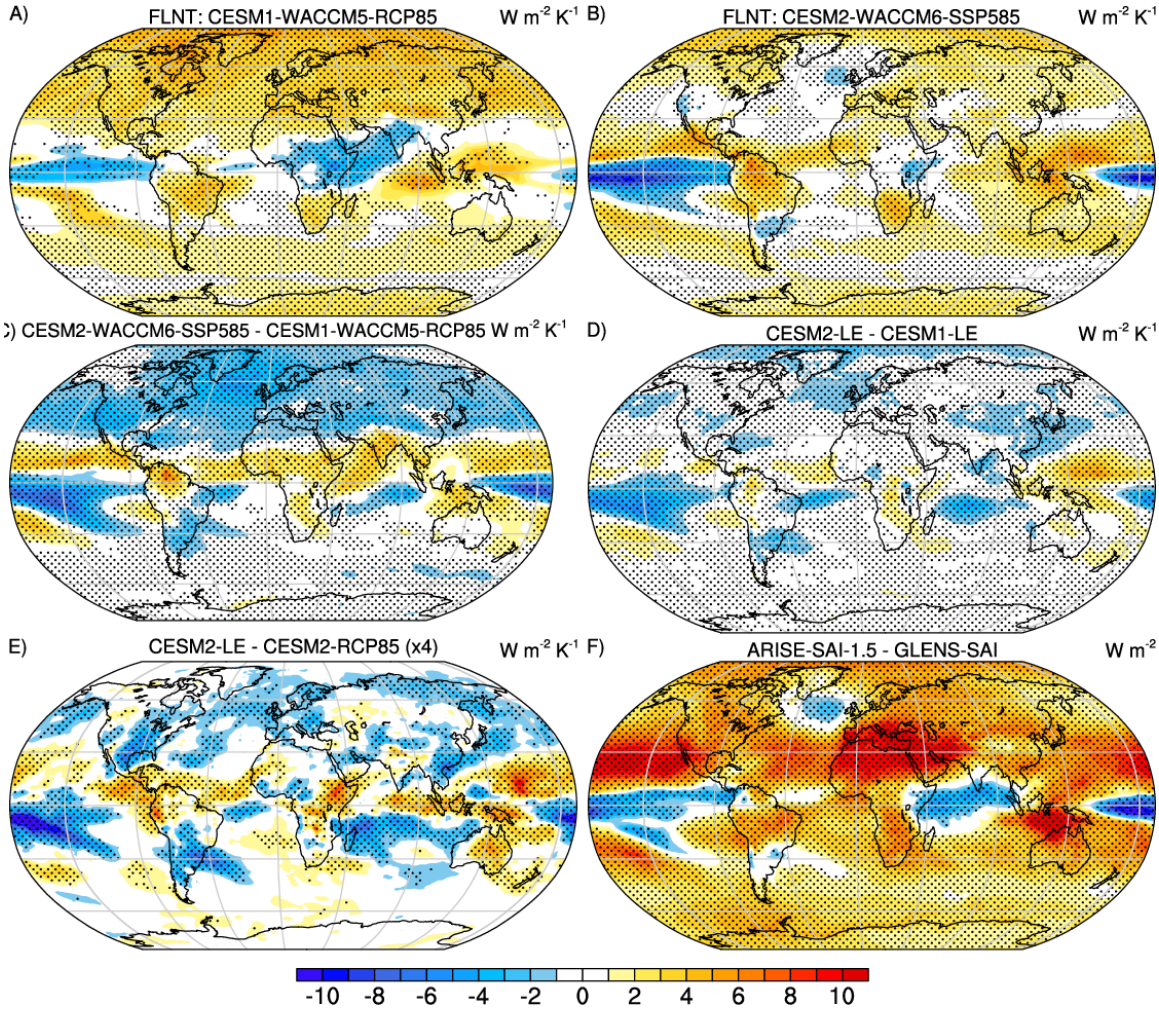

Figure S2. Normalized response in outgoing top-of-atmosphere longwave flux (FLNT) per degree global warming estimated from the change between 2020-39 and 2050-69 for unmitigated (a) CESM1-WACCM5-RCP85 and (b) CESM2-WACCM6-SSP585 simulations, and (c) their difference (b-a). Also shown is (d) the analogous difference for the CESM1-LE and CESM2-LE and (e) the CESM2-RCP85 and CESM2-LE (scaled by 4). The difference between the geoengineered climate states in ARISE-SAI-1.5 and GLENS-SAI is shown in (f). Units for all panels are W m^{-2} K^{-1}, except in (f) where units are W m^{-2}, and stippled regions indicate differences that exceed twice the ensemble standard error.

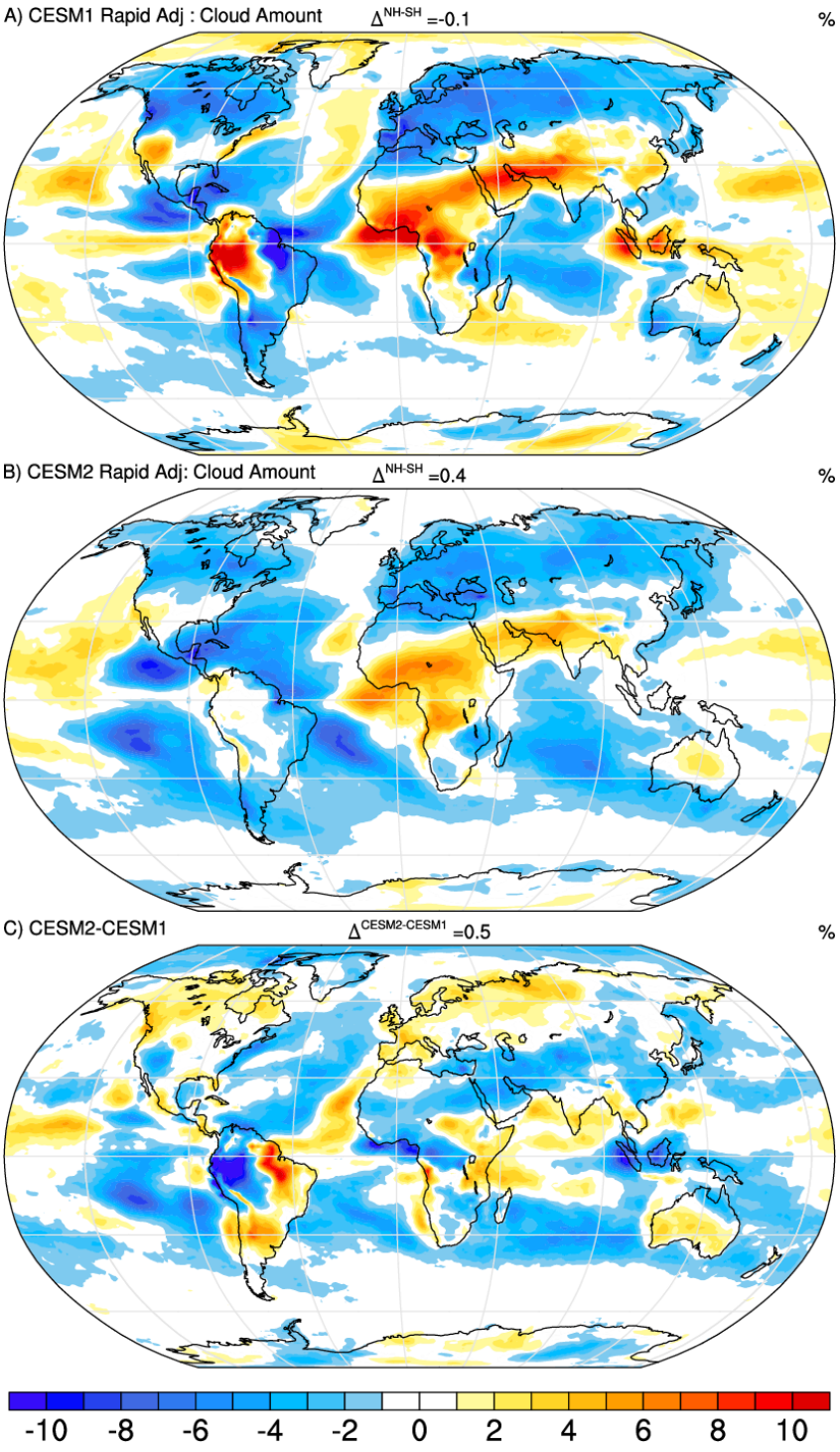

Figure S3. Rapid adjustments of cloud amount (%) to CO_2 based on 4xCO2AMIP-AMIP simulation differences in (a) CESM1, (b) CESM2, and (c) their difference (b-a).

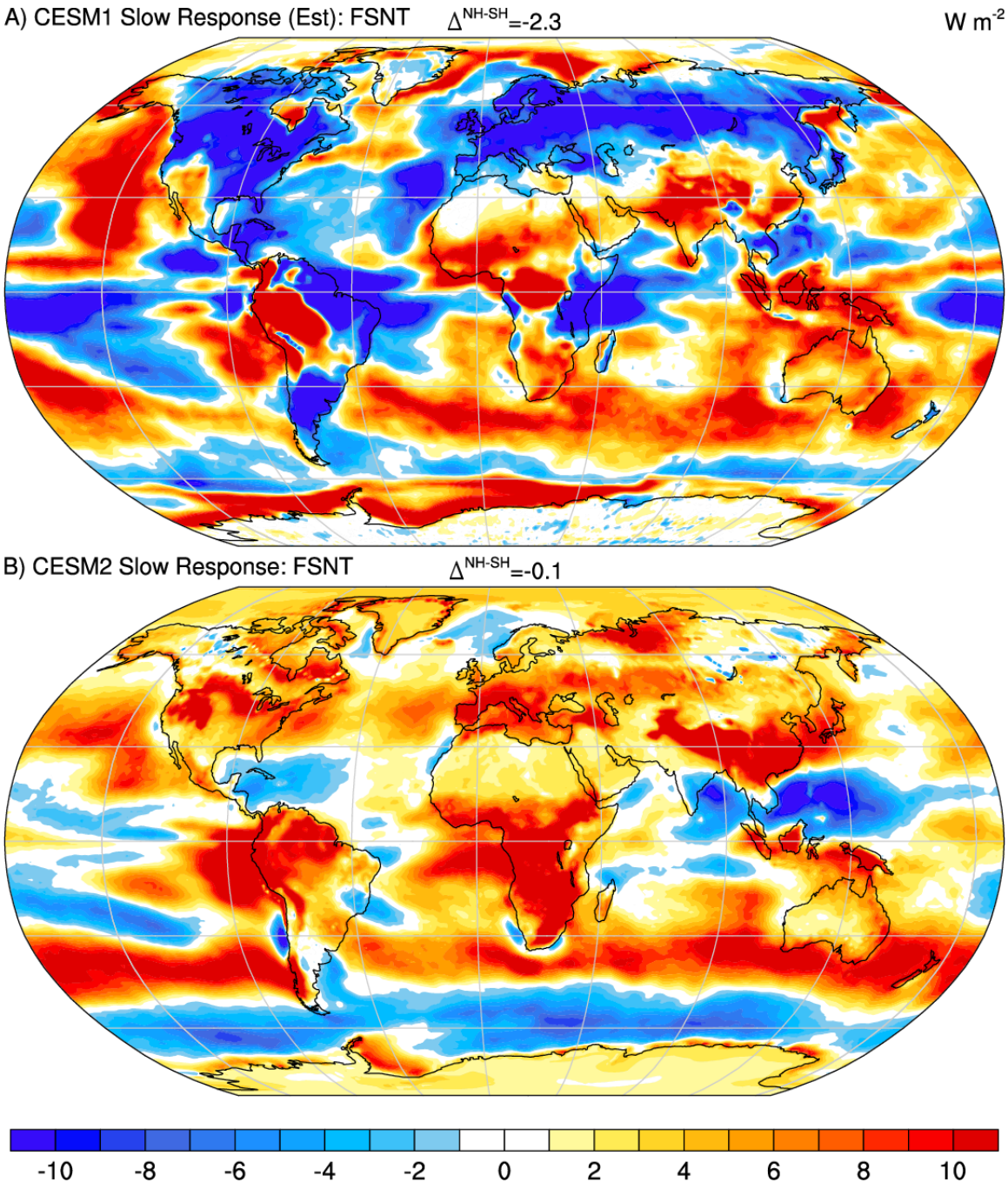

Figure S4. Slow responses of FSNT (W m^{-2}) to CO_2 estimated from abrupt4xCO2 simulations in CESM1 (a), and computed directly from AMIP+4K-AMIP simulation differences in CESM2 (b). The hemispheric contrasts are large for CESM1 (-2.3 W m^{-2}) and small for CESM2 (0.1 W m^{-2}).

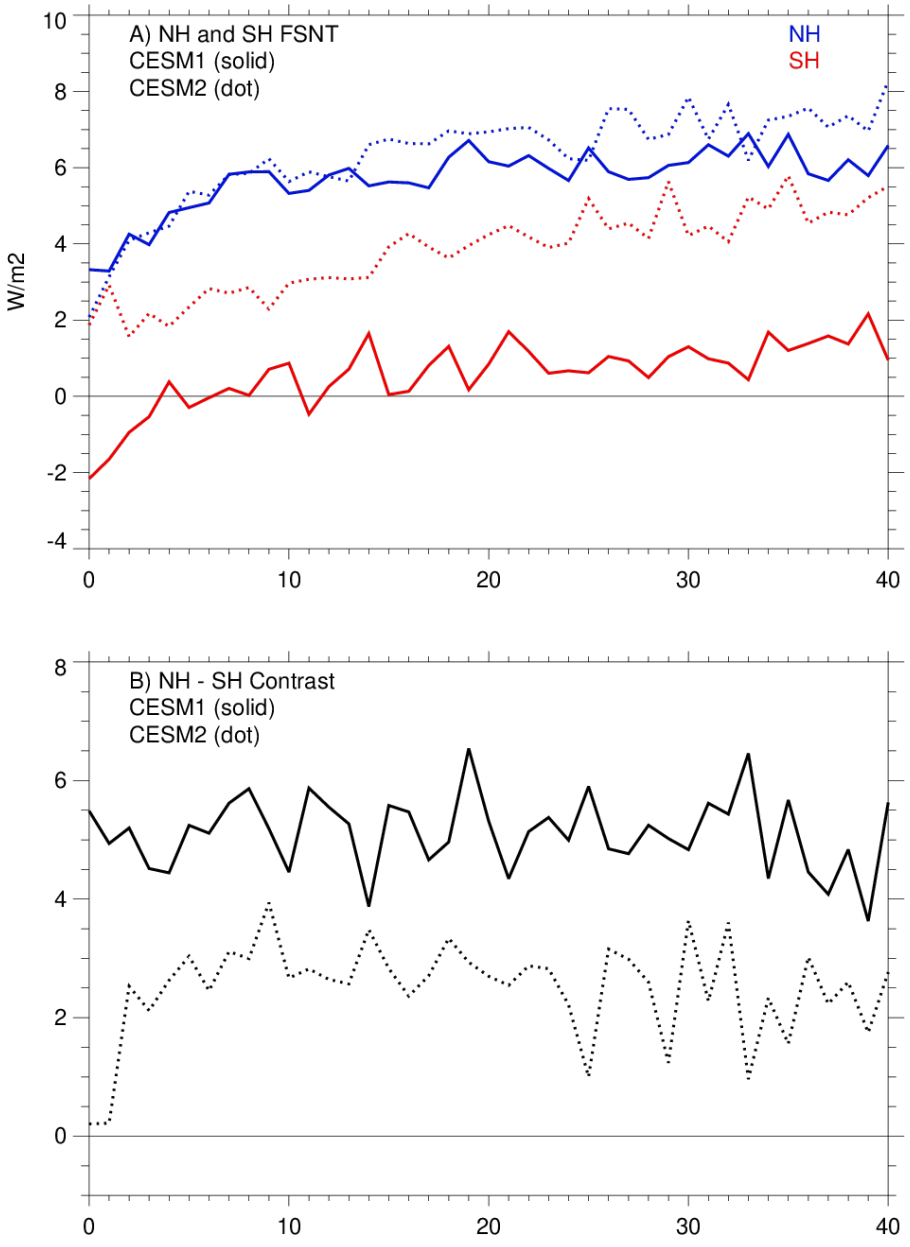

Figure S5. Timeseries of hemispheric mean fluxes (a) and their differences (b) in abrupt4xCO2 simulations.

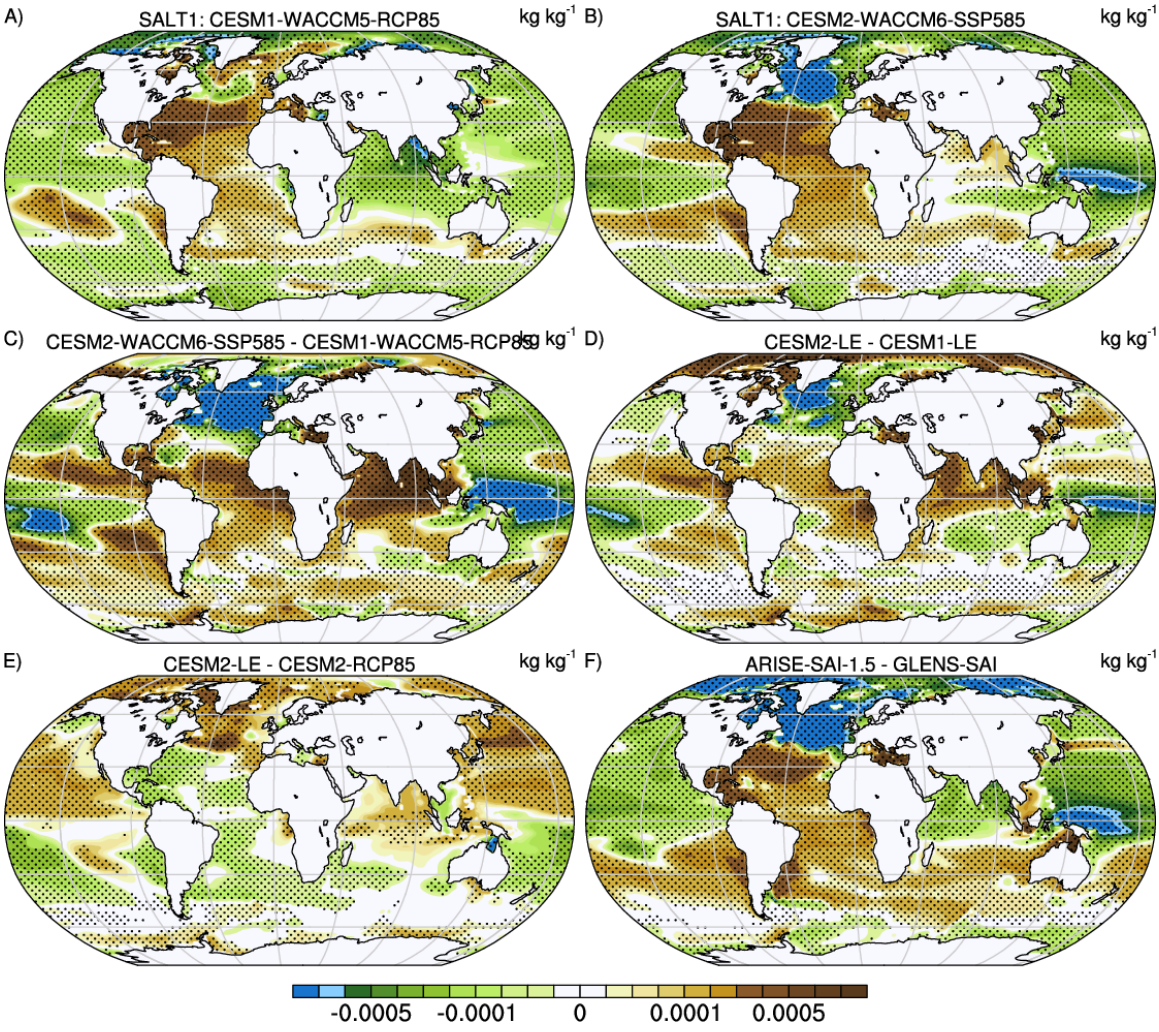

Figure S6. Response in surface salinity estimated from the change between 2020-39 and 2050-69 for unmitigated (a) CESM1-WACCM5-RCP85 and (b) CESM2-WACCM6-SSP585 simulations, and their difference (c). Also shown is the analogous difference for (d) the CESM1-LE and CESM2-LE (d) and (e) the CESM2-RCP85 and CESM2-LE. The difference between the geoengineered climate states in ARISE-SAI-1.5 and GLENS-SAI is shown in (f).

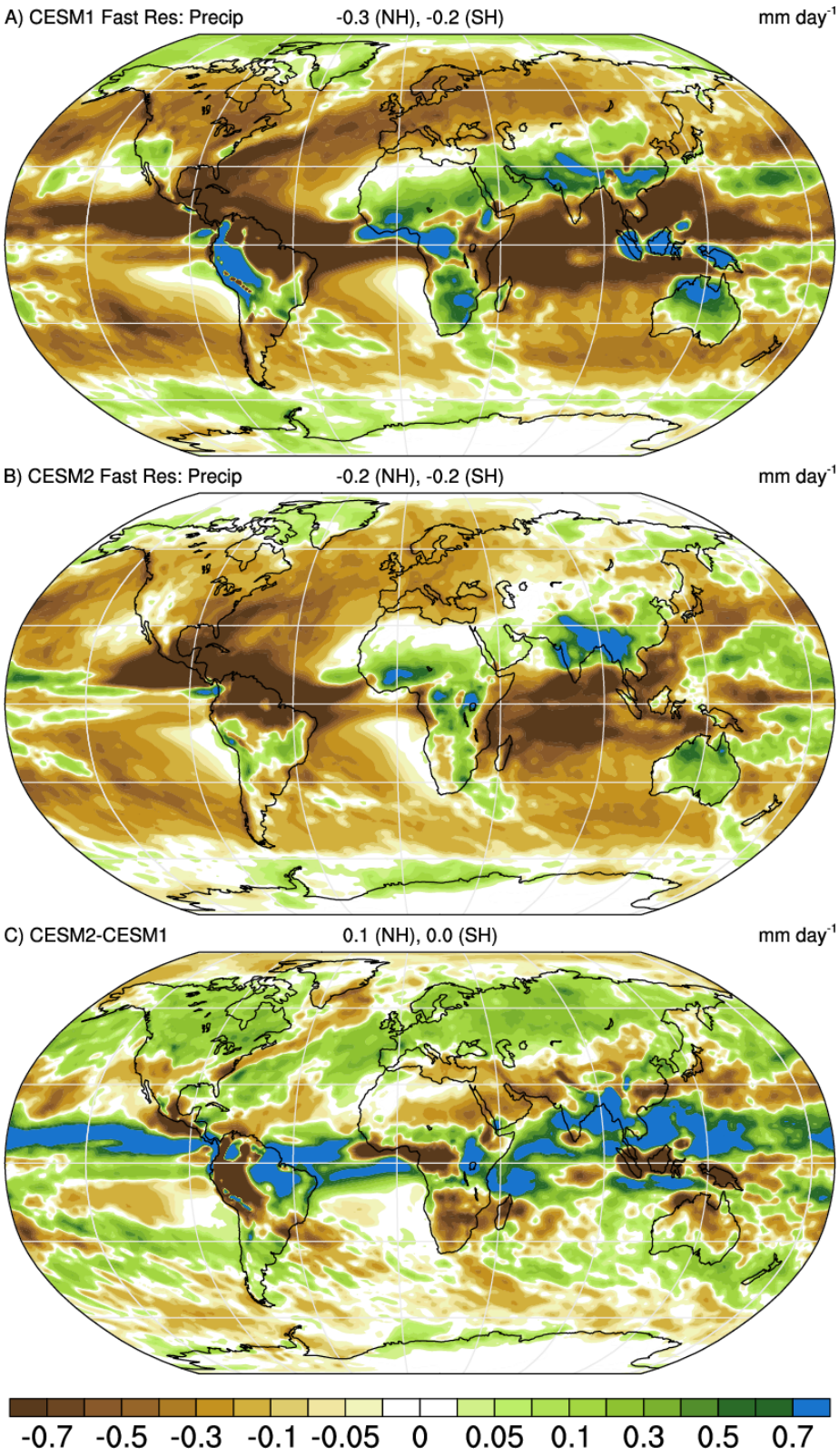

Figure S7. Rapid adjustments of precipitation (mm day^{-1}) to CO_2 based on 4xAMIP-AMIP simulation differences in (a) CESM1, (b) CESM2, and (c) their difference (b-a).