Supporting Information for

Influence of ENSO on stratospheric sulfur dioxide injection in the CESM2 ARISE-SAI-1.5 simulations

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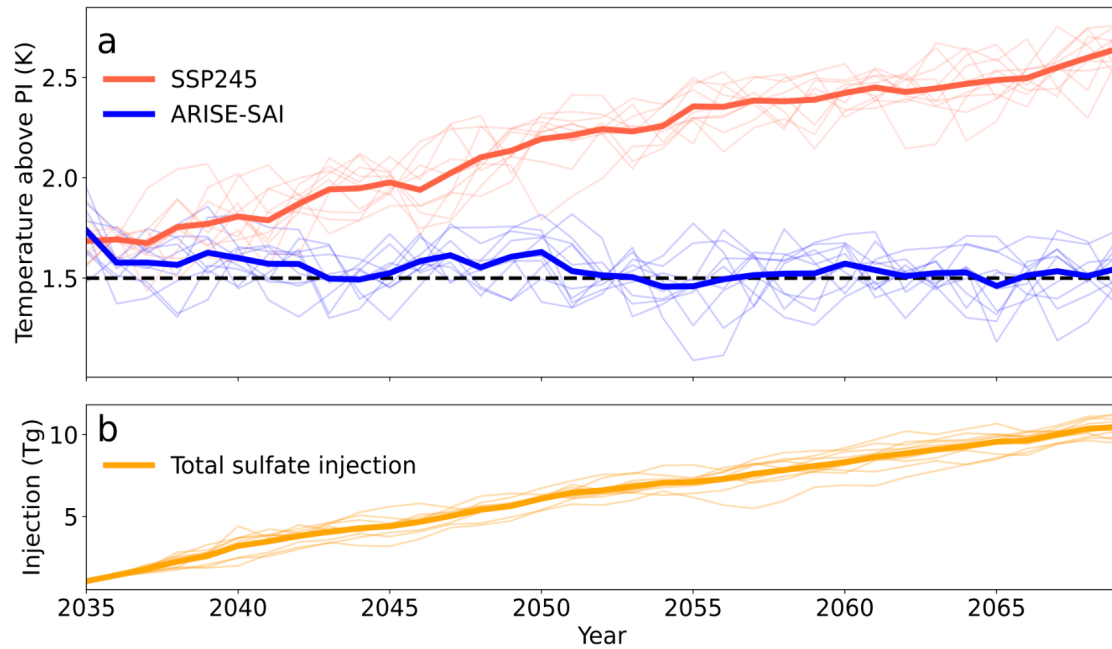
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Figure S1. (a) Simulated global mean surface temperature (GMST) above the Pre-industrial (PI) level in SSP2-4.5 (red) and ARISE-SAI (blue) simulations. The thicker lines represent the ensemble-average results, while the thin lines indicate the results from each ensemble member. The black dash line indicates the GMST target (around 1.5 ℃ above PI level) set in ARISE-SAI runs; (b) The total sulfate injection amount (Tg) in ARISE-SAI simulations. The thicker lines represent the ensemble-average results, while the thin lines indicate the results from each ensemble member.
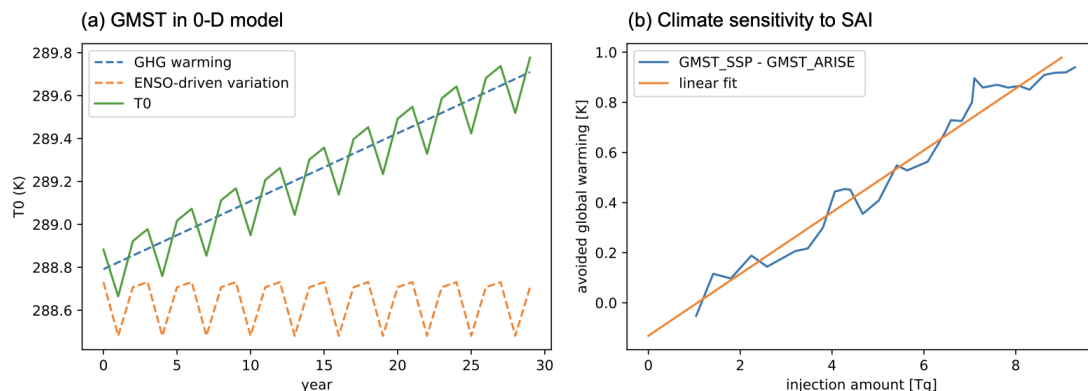
Figure S2. (a) The simplified GMST in SSM. The solid line represents the GMST in the SSM; the straight dashed line represents the GHG warming calculated based on the linear fit of GHG warming in the SSP2-4.5 simulation; the dashed curve represents the simplified ENSO-driven GMST variation; (b) Climate sensitivity to SAI in CESM2(WACCM6) (blue) and the linear fit of the sensitivity (orange) based on the ensemble-averaged result from ARISE-SAI and SSP2-4.5 simulations. The avoided global warming is defined as the difference of GMST between SSP2-4.5 and ARISE-SAI. The linear fit of climate sensitivity is applied in the SSM as its simplified climate sensitivity to SAI.
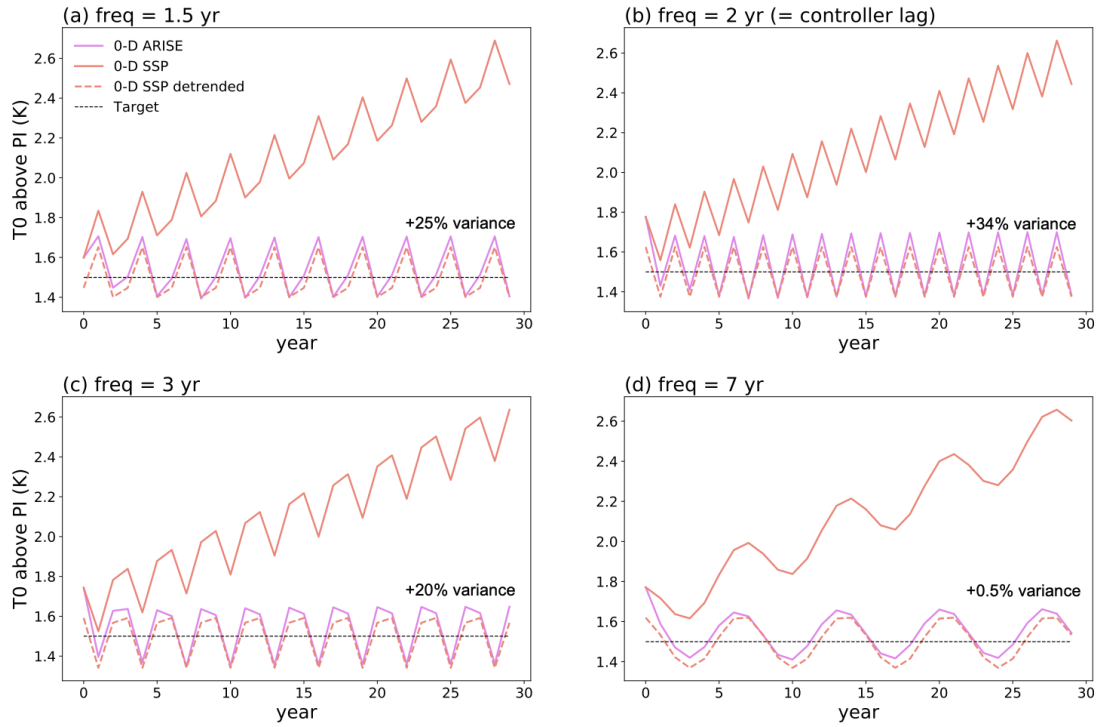
Figure S3. The results of climate intervention in the SSM when the idealized "ENSO" varies at different variation frequencies. The controller's detection frequency is set to the default value (one year). The red line represents the GMST without climate intervention (SSM-SSP), whereas the blue line represents the GMST with climate intervention (SSM-ARISE). The orange line indicates the detrended GMST without climate intervention (SSM-SSP detrended), driven by the idealized ENSO in the SSM.