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Exploring divergent long-term stratospheric aerosol injection scenarios with the G2-SAI and ARISE-hybrid experiments

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Table of Contents

S1: Injection rate variability

Here, we provide additional details regarding SO_2 injection rates for the G2-SAI simulations. In the following table, for the six 25-year periods spanning the 150-year G2-SAI scenario, we provide mean and standard deviation (σ) for cooling per unit injection and injection rate, as well as the injection rate σ-to-mean ratio. Values are the average of the three G2-SAI simulations. Data are presented to demonstrate trends; the number of significant digits used in each column is not meaningful.

Table S1: statistics for six 25-year periods of the G2-SAI experiments, averaged over all three simulations. "Cooling" refers to change in global mean temperature for G2-SAI relative to the same time period of 1%CO_2. Mean and standard deviation (σ) are for the 25 data points of the ensemble mean during the given time period.

Years of injection	Mean cooling, °C per Tg/yr	Cooling σ, °C per Tg/yr	Mean injection rate (Tg)	Injection rate σ (Tg)	Injection rate σ as % of mean
1-25	0.1035	0.0584	3.73	1.45	39%
25-50	0.1068	0.0144	11.22	2.87	26%
51-75	0.0913	0.0083	20.97	4.01	19%
76-100	0.0813	0.0051	33.54	4.21	13%
101-125	0.0762	0.0028	48.70	4.92	10%
126-150	0.0729	0.0018	67.60	5.91	9%

S2: Temperature maps for simulations by MacMartin, et al 2022

In the following figure, we provide temperature maps for the SAI simulations conducted by MacMartin, et al 2022 (Scenarios for modeling solar radiation modification, *Proceedings of the National Academy of Sciences,* 2022, doi 10.1073/pnas.2202230119). Specifically, we compare the simulations with global temperature targets of PI + 1.5°C, PI + 1.0°C, and PI + 0.5°C to their respective SSP2-4.5 reference periods, analogous to the bottom row of our Fig. 6.

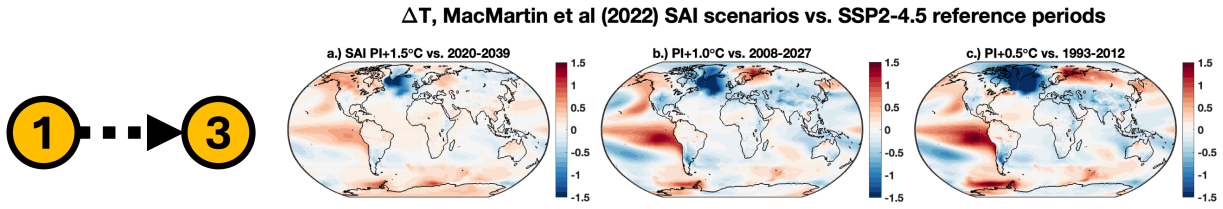

Fig. S1: ensemble mean difference in near-surface temperature for SAI simulations (years 2050-2069) of MacMartin, et al (2022) vs. their respective SSP2-4.5 reference periods (periods in which global mean T is the same as the temperature target in the SAI scenario, shown in panel titles). Simulations use CESM2 with the "middle atmosphere" version of WACCM ("WACCM-MA") as the atmospheric component. Periods (1) and (3), as displayed on the left, are consistent with the definitions introduced in Fig. 6 in the main text.

S3: Precipitation zonal mean maps for G2-SAI

In the following figure, we present maps of changes in zonal mean precipitation for PI control, 1%CO_2, G2-SAI, SSP2-4.5, ARISE-SAI-1.5, and G6-1.5K-SAI scenarios. The top row plots changes for warming scenarios relative to baseline; the middle row plots changes for SAI scenarios relative to warming scenarios; and the bottom row plots SAI scenarios relative to baselines.

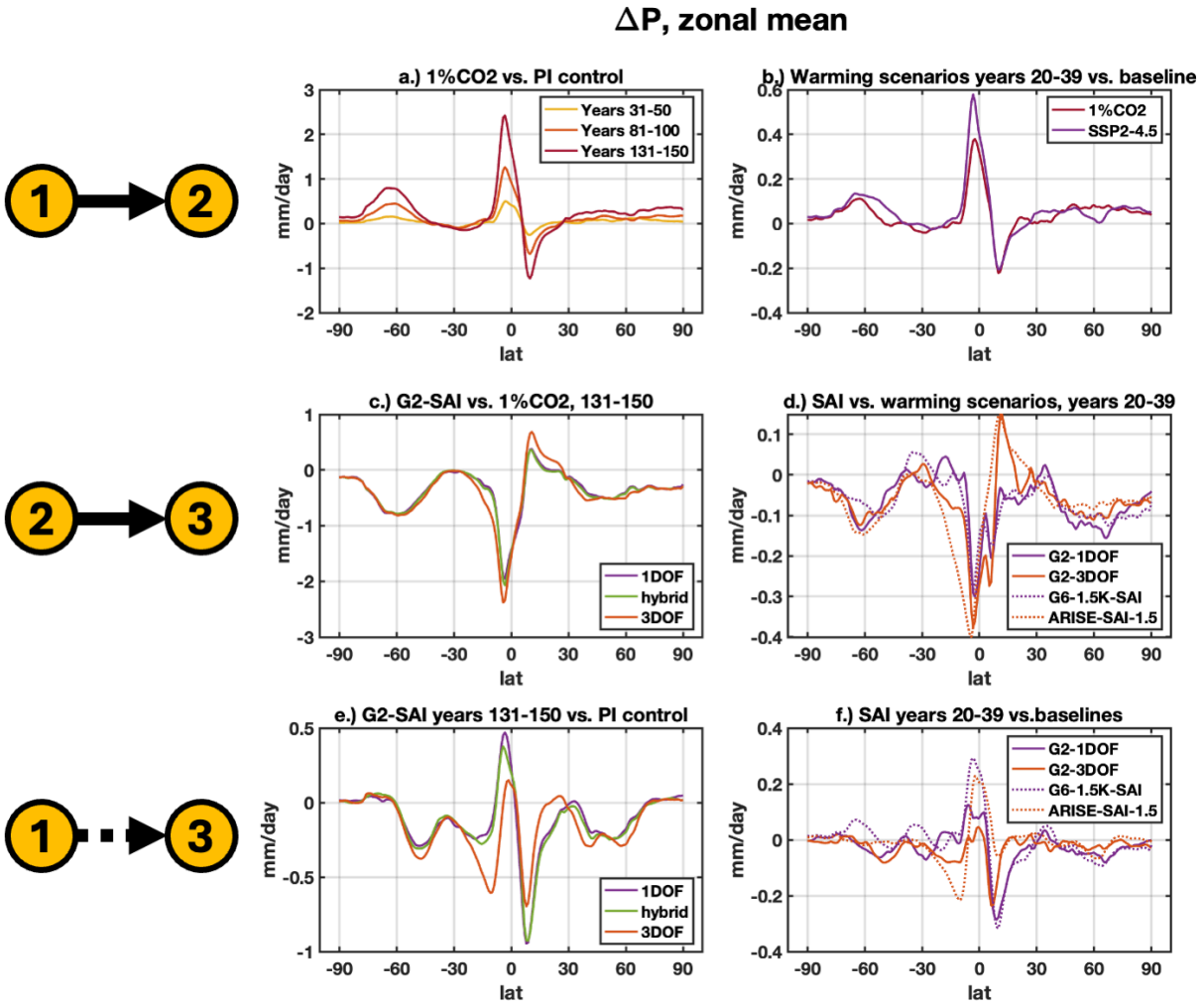

Fig. S2: maps of changes in zonal mean precipitation for selected periods of selected simulations. For simulations with multiple ensemble members, ensemble means are used. Periods (1), (2), and (3), as displayed on the left, are defined in Fig. 6 of the main text.

S4: T_0, T_1, and T_2 for ARISE-hybrid

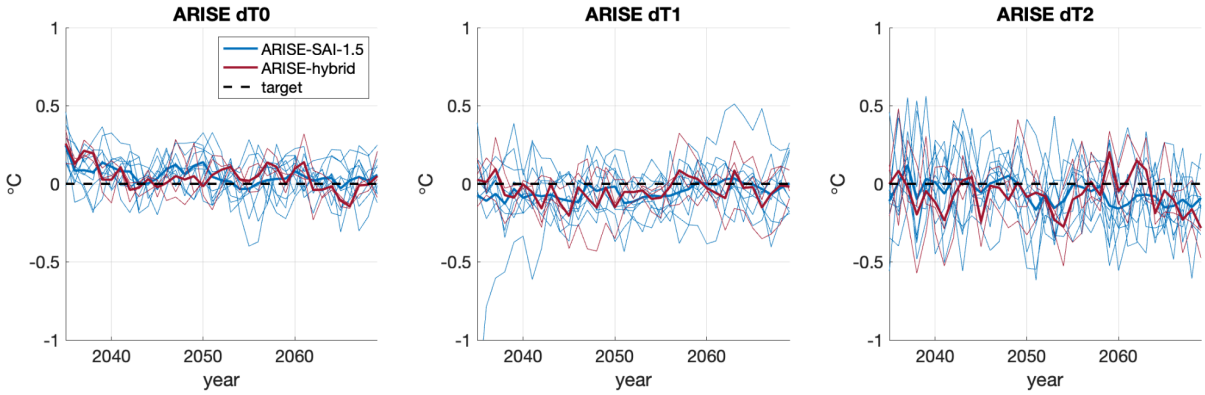

Figure S3: T_0, T_1, and T_2 for the ARISE-SAI-1.5 and ARISE-hybrid simulations, relative to the temperature targets. Thin lines denote individual ensemble members; thick lines denote ensemble means.