Supporting Information for "Aggressive aerosol mitigation policies reduce chances of keeping global warming to below +2 C."

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Introduction

This supporting document includes additional information about the analysis choices we made for calculating the change between present and future climates and about CMIP6

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ScenarioMIP *AOD* model behaviors (Text S1). Additionally, we provide two supporting tables: one for model details (S1) and one for the mean and standard error values from the analysis calculations presented in the manuscript (Table S2). Finally, we share two supporting figures to augment the analysis in the main manuscript.

Text S1. Analysis results are largely insensitive to the length of the averaging period used in estimating change from the present to future climate over the range 10-20 years. We have chosen to utilize 10-year averaging periods (i.e., 2015-2025 and 2045-2055) in our difference calculations in order to reduce the noise compared with analysis of a single year.

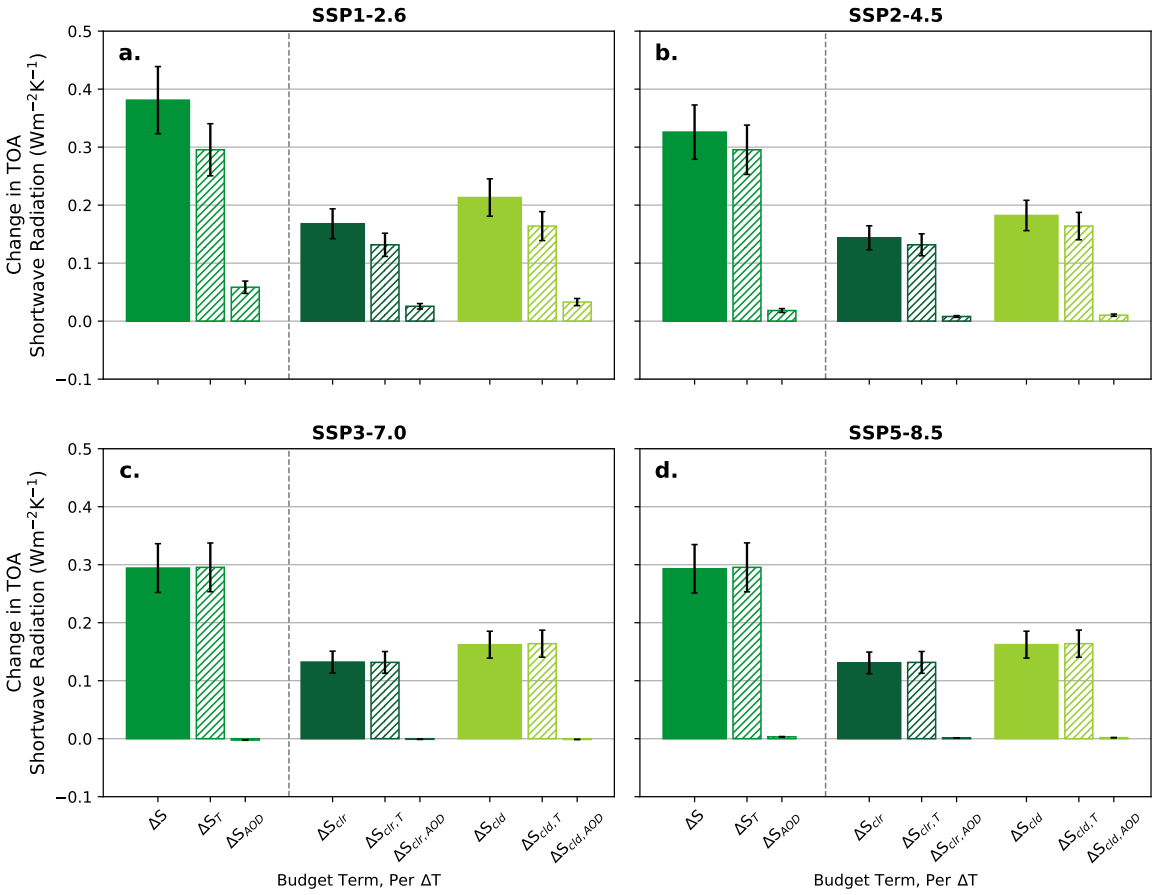

Figure S1. Apportionment of changes in TOA SW radiation due to changes in surface albedo ΔS (solid green bars on left side of each panel) from the APRP analysis over the 21st century (2090–2100 minus 2015–2025). Changes are all normalized by the global mean surface air temperature changes over the same period. Bars represent multi-model means while error bars show 2 standard errors (∼95% confidence) based on the variability in the multi-model mean 10-year periods propagated through the change and normalization calculations. ΔS is broken into contributions from non-cloud (solid dark-green) and cloudy (solid yellow-green) components. Each component is regressed against ΔT and ΔAOD and those dependencies are provided, respectively, in the hatched bars to the right of the solid bars.

Table S1. Individual CMIP6 Models used in ScenarioMIP Ensemble

Model	Member
CanESM5	r1i1p1f1
CESM2-WACCM	r1i1p1f1
CMCC-CM2-SR5	r1i1p1f1
CMCC-ESM2	r1i1p1f1
CNRM-CM6-1	r1i1p1f2
CNRM-CM6-1-HR	r1i1p1f2
CNRM-ESM2-1	r1i1p1f2
GFDL-ESM4	r1i1p1f1
INM-CM4-8	r1i1p1f1
INM-CM5-0	r1i1p1f1
IPSL-CM6A-LR	r1i1p1f1
MIROC6	r1i1p1f1
MIROC-ES2L	r1i1p1f2
MPI-ESM1-2-HR	r1i1p1f1
MPI-ESM1-2-LR	r1i1p1f1
MRI-ESM2-0	r1i1p1f1
NorESM2-LM	r1i1p1f1
UKESM1-0-LL	r1i1p1f2

Table S2. ScenarioMIP Global Ensemble Mean, SE Changes and Quantities

Variable	Units	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5
ΔT	K	0.78±0.04	1.83±0.09	3.00±0.15	3.92±0.20
ΔAOD	$\cdot 10^{-2}$	-2.07±0.10	-1.51±0.08	0.31±0.02	-0.57±0.03
ΔSW	Wm^{-2}	1.63±0.08	2.32±0.12	3.08±0.15	4.13±0.20
ΔLW	Wm^{-2}	-1.79±0.09	-1.84±0.09	-1.64±0.08	-2.24±0.11
ΔC	Wm^{-2}	0.93±0.04	0.97±0.05	0.89±0.05	1.38±0.07
ΔC_{scat}	Wm^{-2}	0.71±0.03	0.48±0.03	-0.03±0.01	0.30±0.01
ΔC_{abs}	Wm^{-2}	-0.02±0.001	-0.08±0.004	-0.16±0.01	-0.23±0.01
ΔC_{amt}	Wm^{-2}	0.23±0.01	0.58±0.03	1.08±0.05	1.30±0.07
ΔN	Wm^{-2}	0.43±0.02	0.77±0.04	1.33±0.07	1.63±0.08
ΔN_{scat}	Wm^{-2}	0.39±0.02	0.22±0.01	-0.17±0.01	-0.04±0.01
ΔN_{abs}	Wm^{-2}	0.04±0.01	0.55±0.03	1.50±0.07	1.67±0.09
ΔS	Wm^{-2}	0.30±0.02	0.60±0.03	0.88±0.04	1.15±0.06
ΔS_{clr}	Wm^{-2}	0.13±0.01	0.26±0.01	0.40±0.02	0.51±0.03
ΔS_{cld}	Wm^{-2}	0.17±0.01	0.33±0.02	0.49±0.02	0.64±0.03

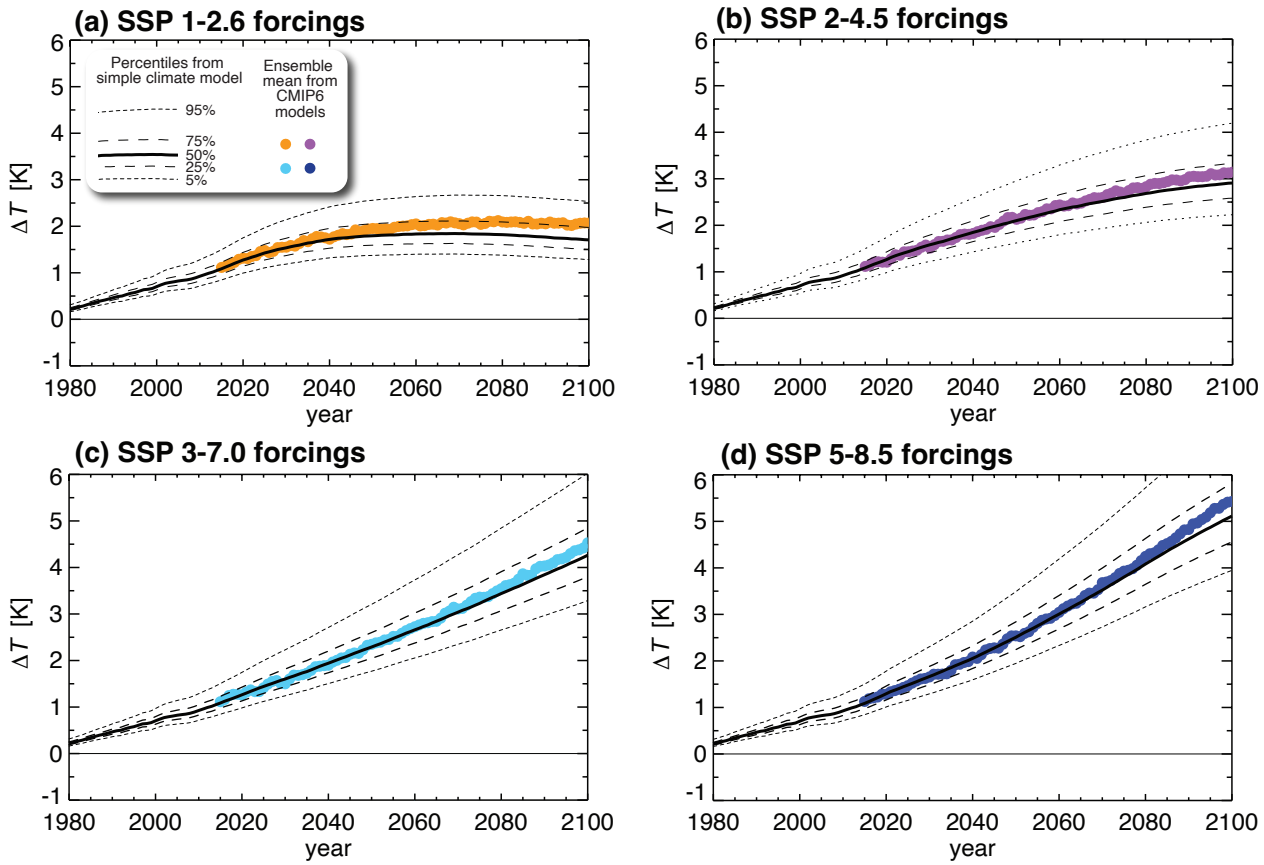

Figure S2. Projected warming from the simple two-layer climate model (black lines) and from the multimodel mean from the 18 CMIP6 models (colored lines). Each panel shows results for one of the four SSPs used in this study. Aerosol forcings The multimodel means from the CMIP6 models agree very well with the 50th percentile warming rates (thick black lines) from the 100,000 simple climate model ensemble members, providing confidence in the projections from the simple model.