

Supplementary Information for

Enhanced atmospheric oxidation toward carbon neutrality reduces methane's climate forcing

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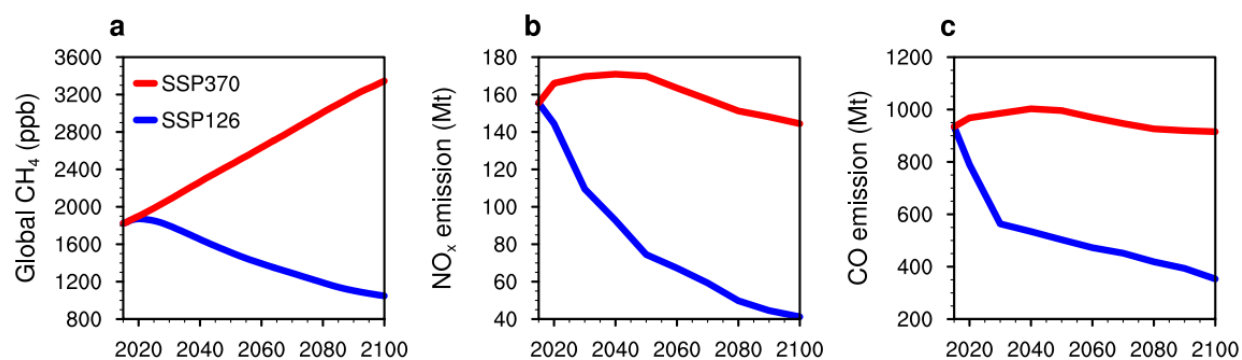
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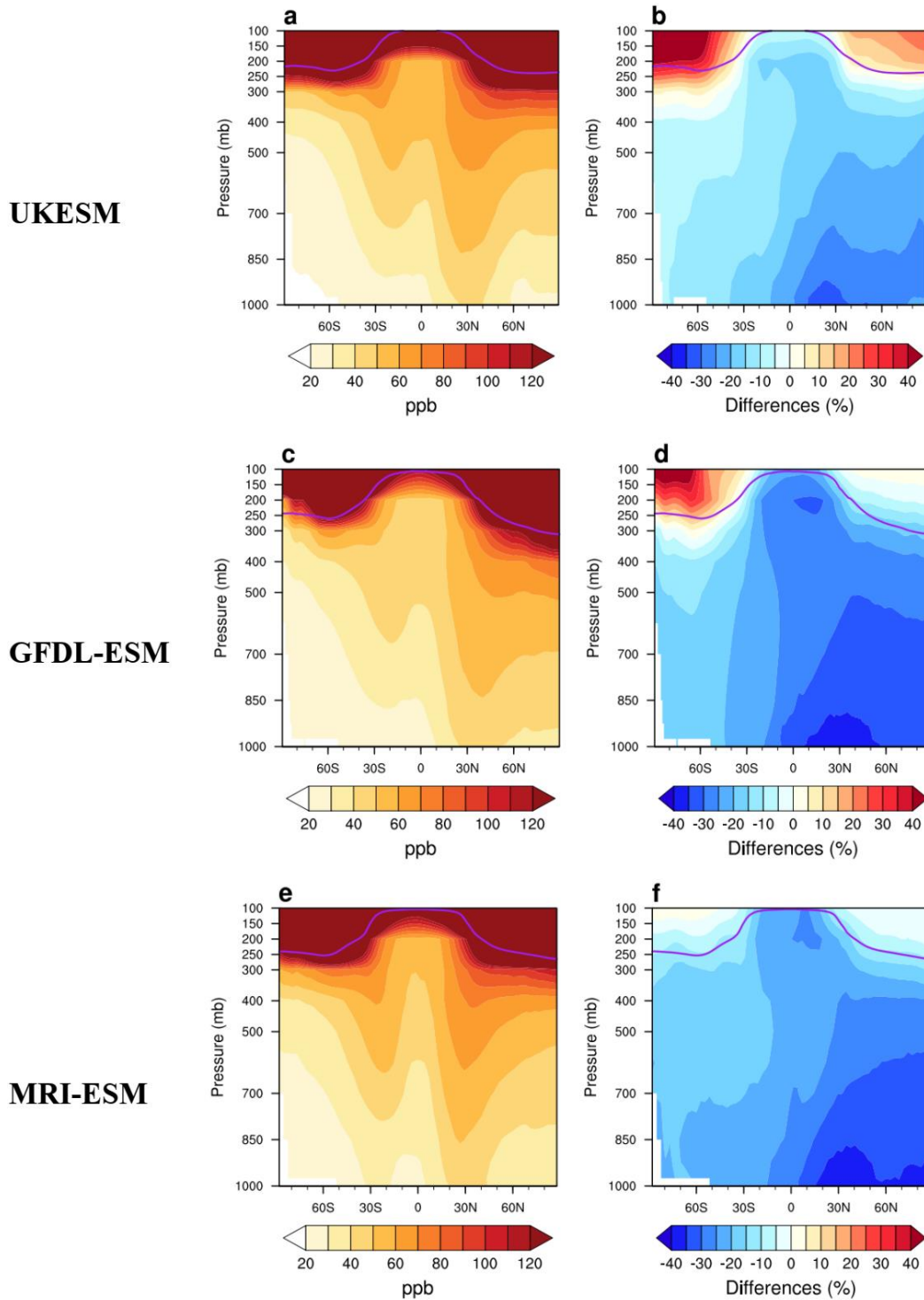
This PDF file includes:

Supplementary Figs. 1-7

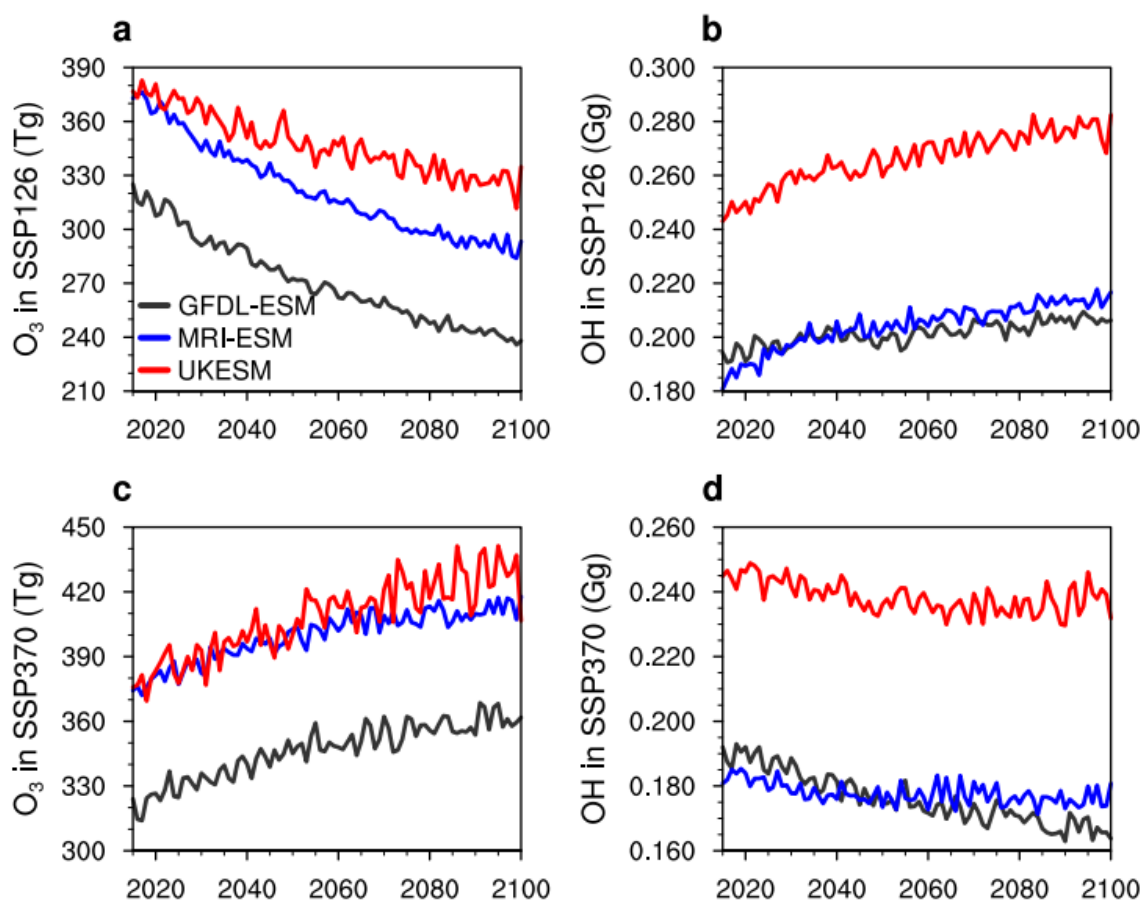
Supplementary Table 1



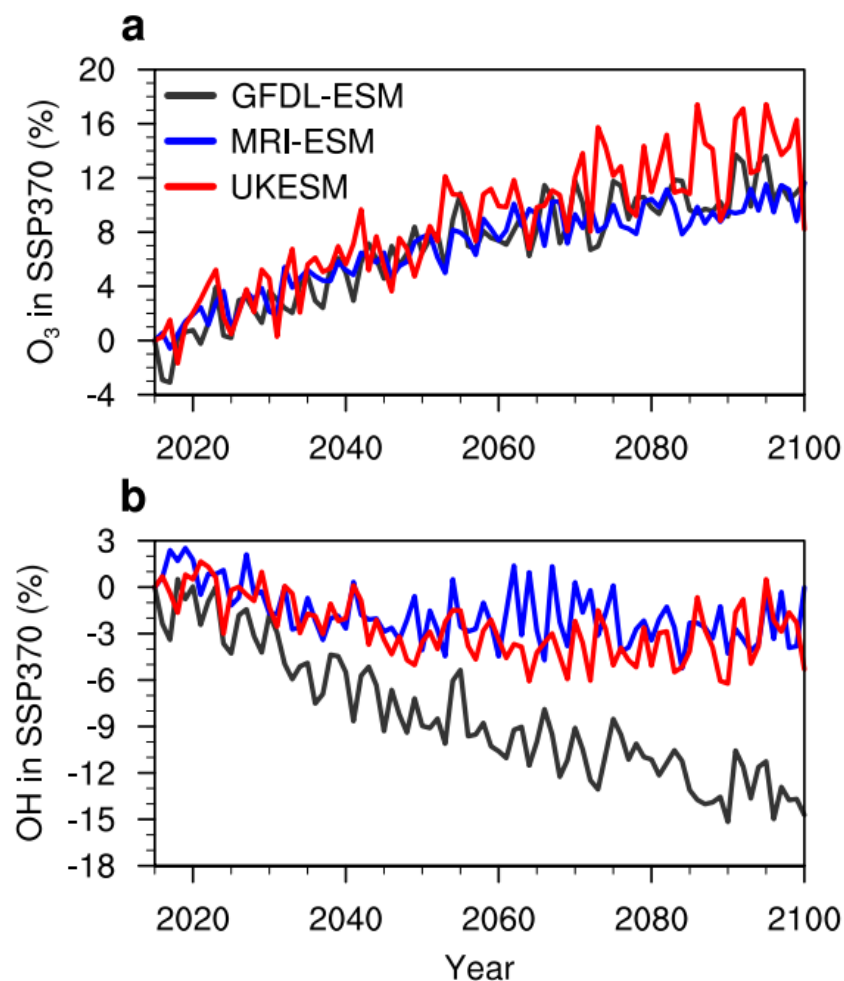
Supplementary Fig. 1 | Concentration and emissions following the SSP126 and SSP370 scenarios used in CMIP6 simulations. The panels show (a) CH₄ global annual mean concentrations from 2015 to 2100, (b) annual emission fluxes of nitrogen oxides (NO_x), and (c) emissions of carbon monoxide (CO).



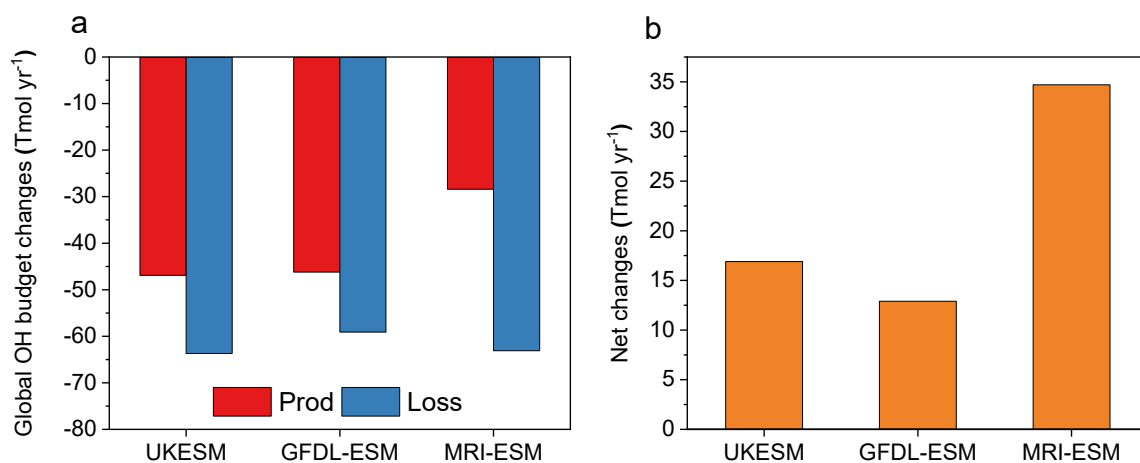
Supplementary Fig. 2 | O₃ mixing ratios and their changes from 2015 to 2100 under a carbon neutrality scenario. Zonal mean mixing ratios and percentage changes in O₃ among the UKESM (a-b), GFDL-ESM (c-d), and MRI-ESM (e-f) models (from top to bottom) in the SSP126 scenario during the 2015–2100 period. The purple solid lines denote the tropopause.



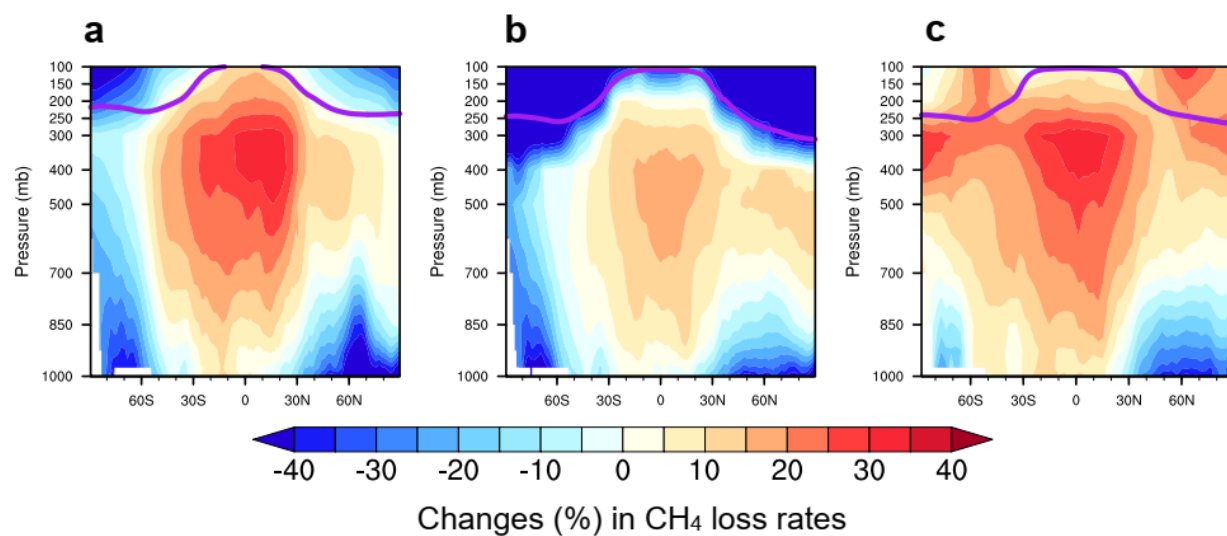
Supplementary Fig. 3 | Interannual variability in simulated tropospheric O₃ and OH concentrations from 2015 to 2100 under the SSP126 and SSP370 scenarios, respectively. Global burdens of (a, c) O₃ and (b, d) OH are derived from climate projections by three Earth system models (i.e., UKESM, MRI-ESM, and GFDL-ESM).



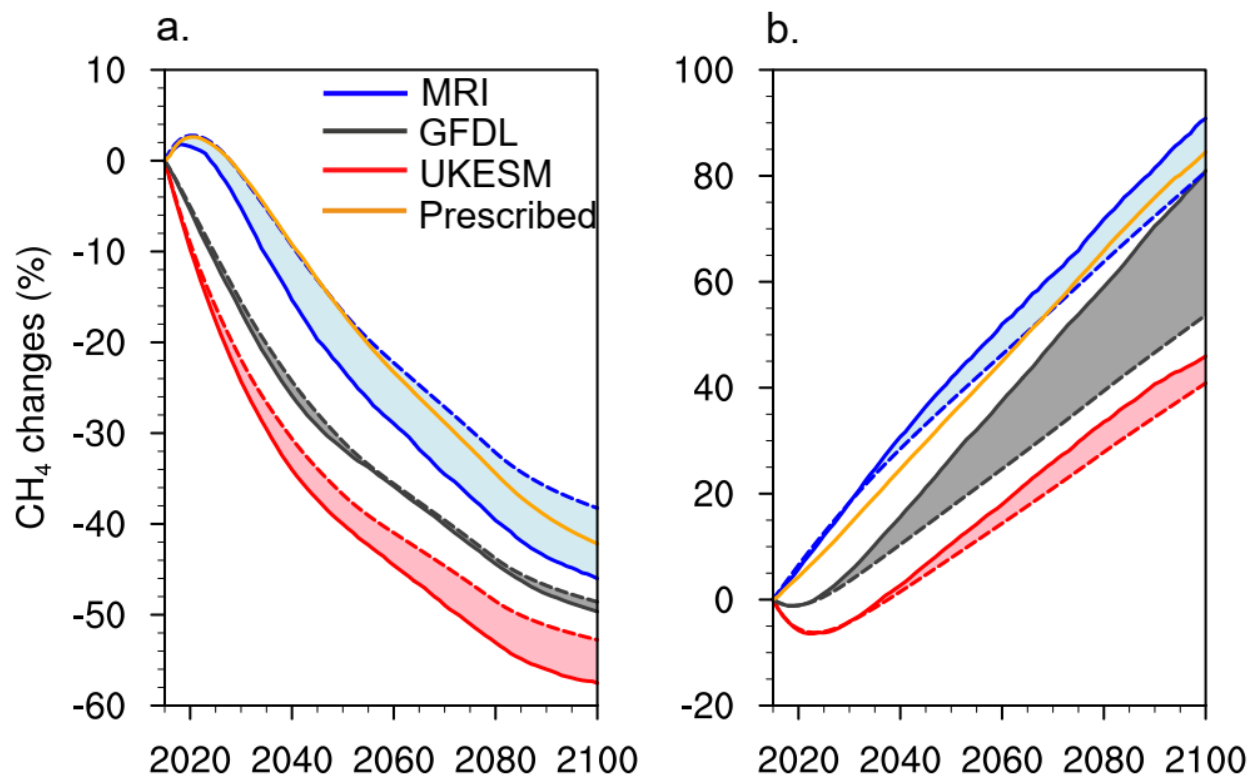
Supplementary Fig. 4 | Relative changes of simulated tropospheric O_3 and OH concentrations compared to the 2015 levels under the SSP370 scenario. Percentage changes in global (a) O_3 and (b) OH are derived from climate projections by three Earth system models (i.e., UKESM, MRI-ESM, and GFDL-ESM).



Supplementary Fig. 5 | Changes in OH production and loss fluxes from 2015 to 2100 in the SSP126 scenario. The panels show (a) the respective changes in global OH sources and sinks calculated using there CMIP6 model results and (b) the net changes in OH budgets.



Supplementary Fig. 6 | Zonal mean changes (%) in CH₄ loss rates (yr⁻¹) derived from the UKESM, GFDL-ESM and MRI-ESM (a-c). These percentage changes were calculated for the Shared Socioeconomic Pathway 1–2.6 scenario during the period of 2015–2100. The purple solid lines denote the tropopause.



Supplementary Fig. 7 | The comparison of the CH₄ trends derived in this study with the CMIP6 prescribed data. The panels show the percentage changes relative to the 2015 levels for the (a) SSP126 scenario and (b) the SSP370 scenario. For our results, the solid and dashed lines stand for the calculation using varying OH and fixed OH, respectively. The same CH₄ emissions are used for deriving our results and the prescribed data.

Supplementary Table

Supplementary Table. 1 | CMIP6 models used in this study.

Model	Institute	Ensemble member
UKESM1-0-LL	MOHC	r1ilp1f2
GFDL-ESM4	NOAA-GFDL	r1ilp1f1
MRI-ESM2-0	MRI	r1ilp1f1