



Supplement of

Impact of future aircraft NO_x emissions on atmospheric composition and climate: dependence on background conditions

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Table S1: NOx emissions (TgNO2 yr-1) used in the different scenarios, for background and aviation. Corresponds to Table 2 in the main text but with emissions quantified.

Label	Background NOx emissions	Aviation NOx Emissions	Description
REF_PD	152.37	3.78	Present Day (PD)
PD_Air-20	152.37	3.02	PD - 20% aviation NOx emissions
REF_SSP1	71.61	2.86	SSP1 baseline
SSP1_Air-20	71.61	2.29	SSP1 - 20% aviation NOx emissions
REF_SSP3BG_SSP1Air	164.04	2.86	SSP1 baseline with SSP3 background
SSP3BG_SSP1Air-20	164.04	2.29	As above - 20% aviation NOx emissions
REF_SSP3	164.04	5.80	SSP3 baseline
SSP3_Air-20	164.04	4.64	SSP3 - 20% aviation NOx emissions
REF_SSP1BG_SSP3Air	71.61	5.80	SSP3 baseline with SSP1 background
SSP1BG_SSP3Air-20	71.61	4.64	As above – 20% aviation NOx emissions

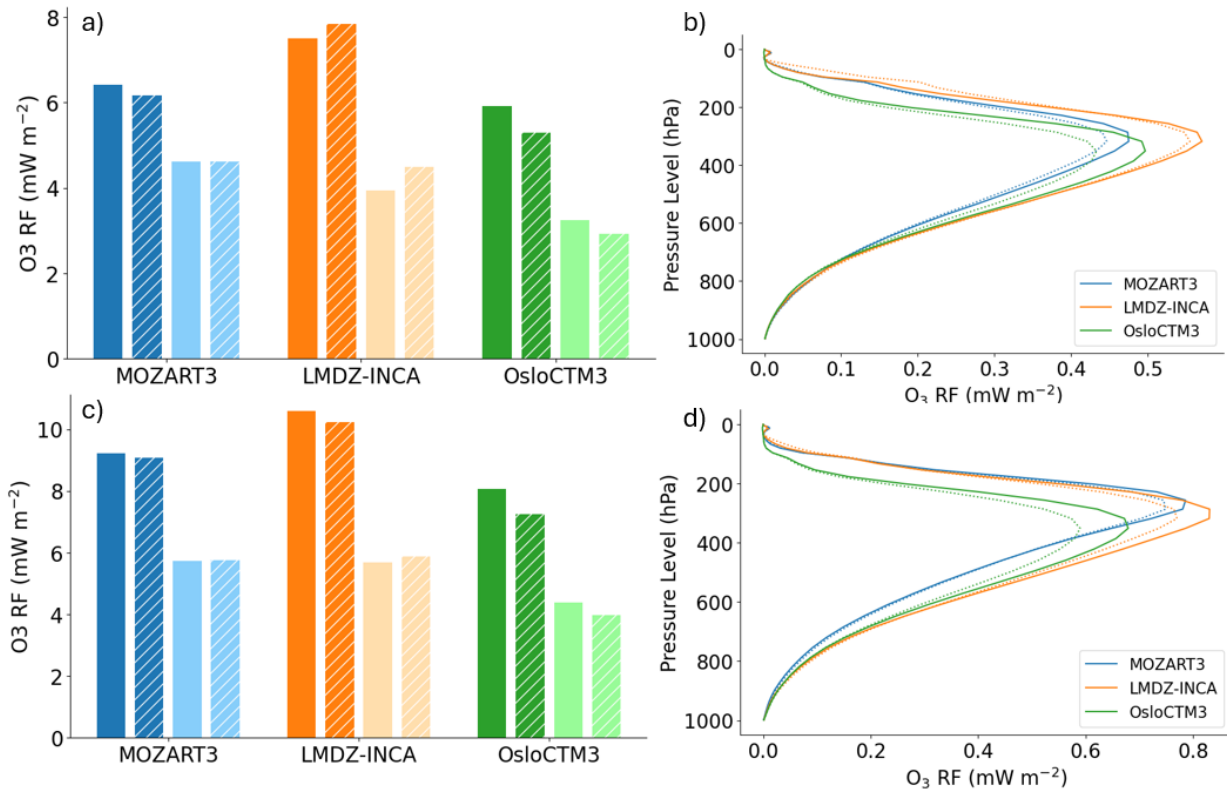


Fig S1: Short-term ozone radiative forcing for a 20% reduction in aviation emissions for SSP3 and SSP1 (darker and lighter colours respectively) with varying background emissions (SSP3 solid and SSP1 hatched) for different months. January: (a) monthly mean ozone RF global sum, (b) vertical profile of difference in ozone RF in SSP1 background compared to SSP3 background for SSP3 emissions. (c) and (d) and the equivalent for May.

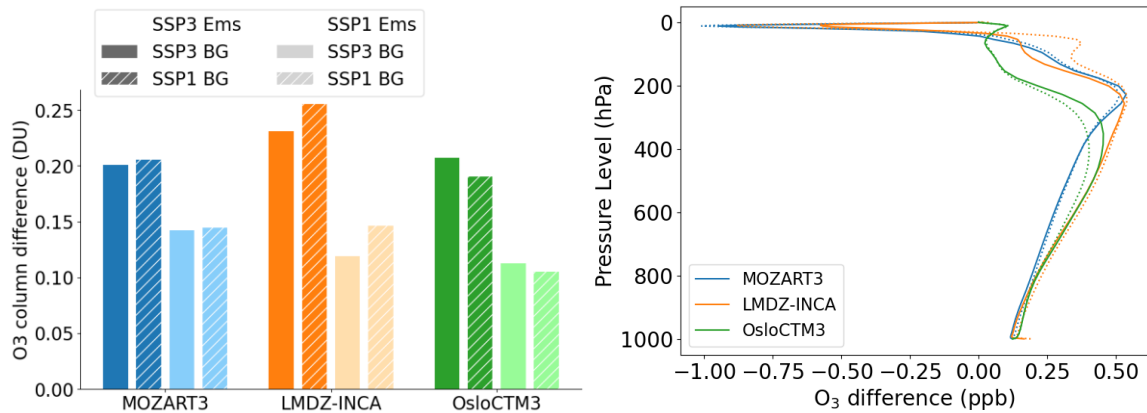


Fig S2: Change in ozone mixing ratio for a 20% reduction in aviation NO_x emissions a) ozone column difference in DU, b) vertical ozone mixing ratio distribution in SSP3 emissions scenario, SSP1 background shown in dashed lines.

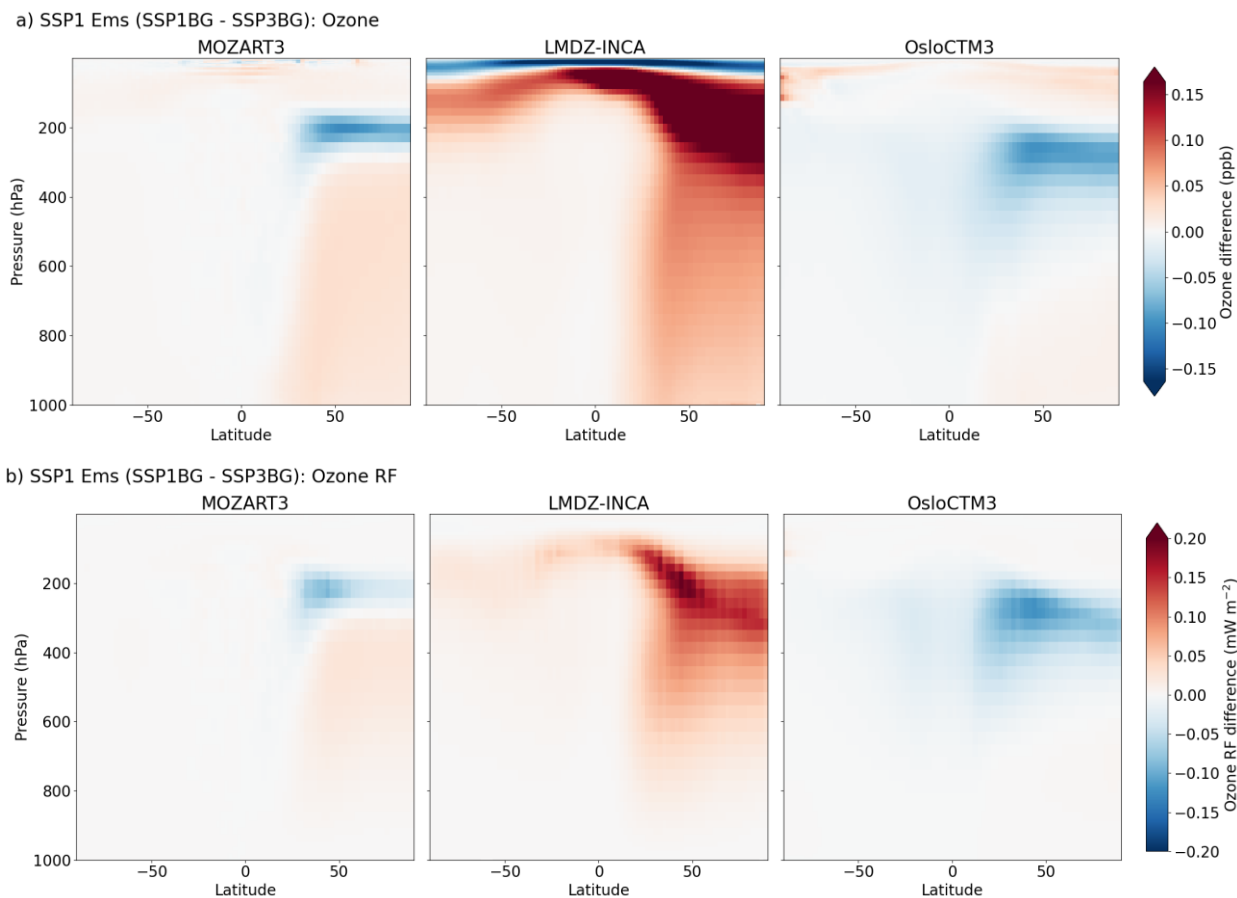


Fig S3: Difference between (a) ozone mixing ratio and (b) ozone RF for a 20% reduction in aircraft NO_x emissions, in SSP1 and SSP3 backgrounds. Positive means that there is greater ozone reduction in SSP1 than in SSP3 background. As Fig 4 but for the SSP1 emissions experiments.

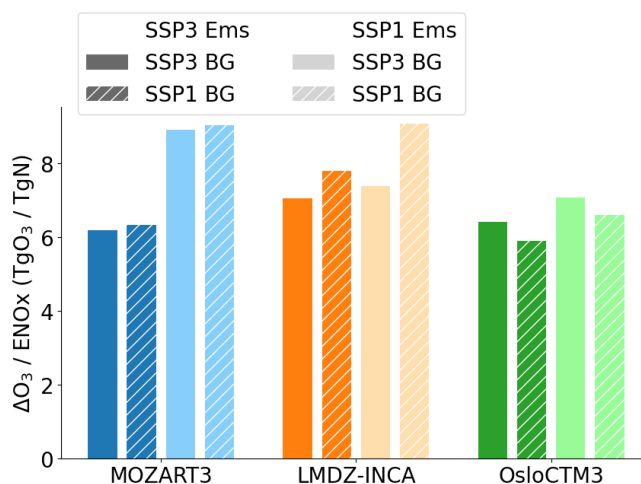


Fig S4: Ozone sensitivity to NO_x emissions (change in burden / change in NO_x emissions, TgO₃ / (TgN yr⁻¹)).

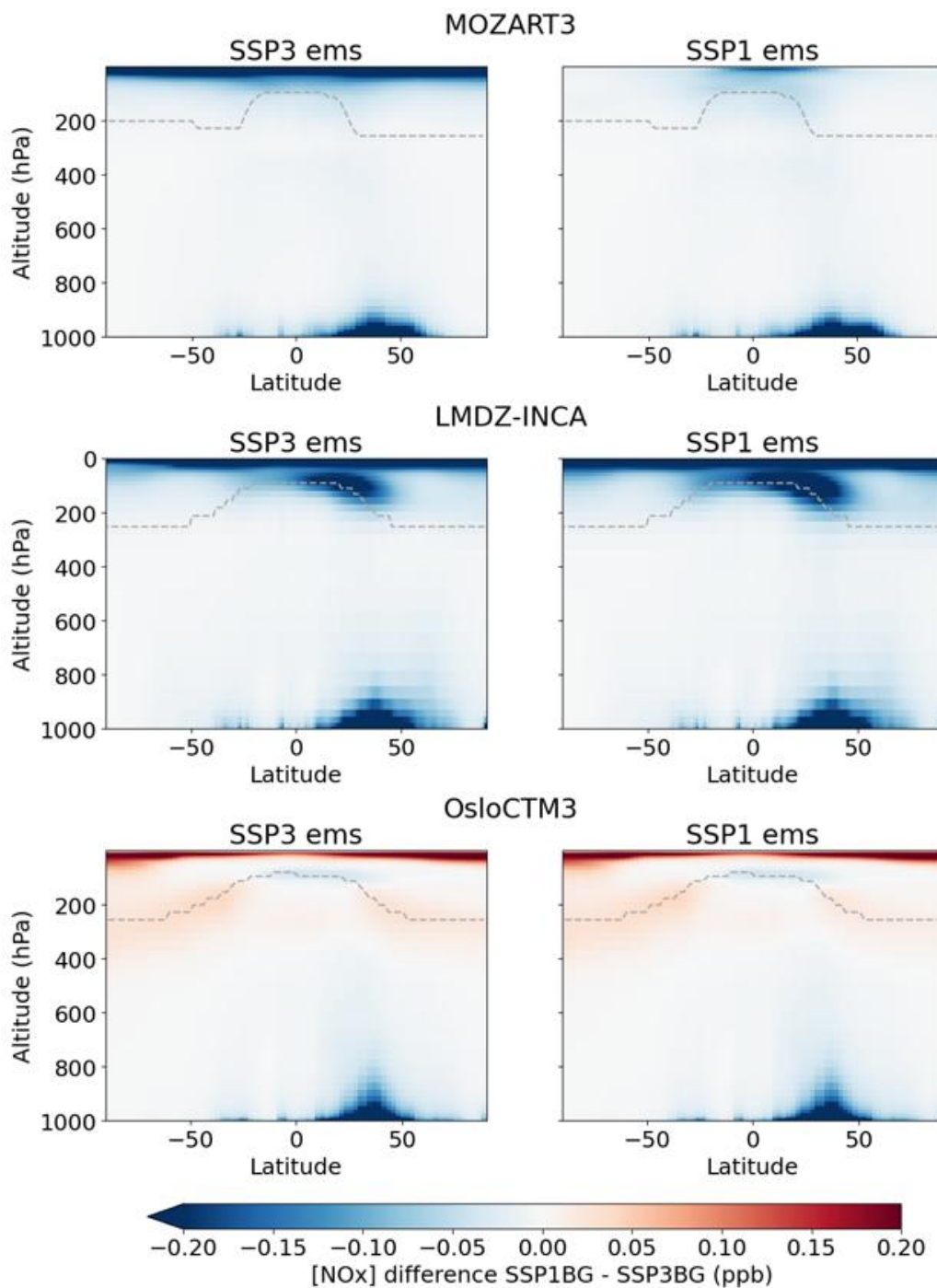


Fig S5: NO_x (NO₂ + NO) concentration differences between SSP3 and SSP1 background scenarios (SSP1 - SSP3), for SSP3 aviation emissions (left) and SSP1 aviation emissions (right). Blue colour corresponds to lower concentration in SSP1.

Table S2: Net NOx component radiative forcing (data for bar chart in Fig 5). All units are mW m⁻². Bold numbers in net NOx column show multi-model mean.

	Short-term O₃	CH₄	Long-term O₃	Strat. H₂O	Net NOx RF
SSP3BG_SSP3AIR					
LMDZ-INCA	45.15	-25.01	-12.13	-3.93	4.08
MOZART3	41.38	-18.77	-9.10	-2.95	10.56
OsloCTM3	37.45	-19.50	-9.46	-3.06	5.44
					6.70
SSP3BG_SSP1AIR					
LMDZ-INCA	23.20	-15.51	-7.52	-2.43	-2.27
MOZART3	27.17	-12.25	-5.94	-1.92	7.053
OsloCTM3	20.33	-12.26	-5.95	-1.92	0.20
					1.66
SSP1BG_SSP3AIR					
LMDZ-INCA	48.30	-31.53	-11.60	-3.75	1.42
MOZART3	41.27	-21.96	-8.08	-2.62	8.62
OsloCTM3	33.50	-21.88	-8.05	-2.60	0.97
					3.67
SSP1BG_SSP1AIR					
LMDZ-INCA	27.40	-21.01	-7.73	-2.50	-3.84
MOZART3	27.17	-14.50	-5.34	-1.73	5.60
OsloCTM3	18.36	-13.94	-5.13	-1.66	-2.38
					-0.21

Table S3: Net NO_x component effective radiative forcing (ERF). All units are mW m⁻². Bold numbers in net NO_x column show multi-model mean. These are calculated from the RFs in Table S1 using ERF/RF ratios from Lee et al. (2021) (see caveats therein). The present-day ERF values are from Cohen et al. (2025b).

	Short-term O ₃	CH ₄	Long-term O ₃	Strat. H ₂ O	Net NO _x ERF
SSP3BG_SSP3AIR					
LMDZ-INCA	61.86	-29.51	-14.32	-4.63	13.40
MOZART3	56.68	-22.14	-10.74	-3.48	20.32
OsloCTM3	51.31	-23.01	-11.16	-3.61	13.53
					15.75
SSP3BG_SSP1AIR					
LMDZ-INCA	31.78	-18.30	-8.88	-2.87	1.73
MOZART3	37.22	-14.45	-7.01	-2.27	13.48
OsloCTM3	27.85	-14.46	-7.02	-2.27	4.10
					6.44
SSP1BG_SSP3AIR					
LMDZ-INCA	66.17	-37.20	-13.69	-4.43	10.85
MOZART3	56.55	-25.92	-9.54	-3.09	18.01
OsloCTM3	45.90	-25.81	-9.50	-3.07	7.51
					12.12
SSP1BG_SSP1AIR					
LMDZ-INCA	37.54	-24.79	-9.12	-2.95	0.67
MOZART3	37.22	-17.11	-6.30	-2.04	11.78
OsloCTM3	25.15	-16.45	-6.05	-1.96	0.68
					4.38
PRESENT DAY					
LMDZ-INCA	43.0	-15.4	-6.24	-2.02	19.4
MOZART3	42.2	-11.5	-4.68	-1.51	24.5
OsloCTM3	33.8	-11.6	-4.73	-1.53	15.9
					19.93

Table S4: Details for the inferred methane perturbations and RF calculated from the modelled methane lifetime change ($\Delta\tau_{\text{CH}_4}$) from the 20% perturbation (reduction) in aviation NOx. Calculated based on the method described in the main text based on Equations 1 and 2.

	$[\text{CH}_4]_{\text{REF}}$ (ppbv)	$\Delta\tau_{\text{CH}_4}$ (%)	ΔCH_4 (ppbv)	$[\text{CH}_4]_{\text{PERT}}$ (ppbv)	RF_{CH_4} (mW m^{-2})
SSP3BG_SSP3AIR					
LMDZ-INCA	2472	-2.354	-67	2405	-25.01
MOZART3	2472	-1.767	-51	2421	-18.77
OsloCTM3	2472	-1.812	-53	2419	-19.50
SSP3BG_SSP1AIR					
LMDZ-INCA	2472	-1.239	-42	2430	-15.51
MOZART3	2472	-0.980	-33	2439	-12.25
OsloCTM3	2472	-0.969	-33	2429	-12.26
SSP1BG_SSP3AIR					
LMDZ-INCA	1519	-3.627	-64	1455	-31.53
MOZART3	1519	-2.536	-45	1474	-21.96
OsloCTM3	1519	-2.490	-45	1474	-21.88
SSP1BG_SSP1AIR					
LMDZ-INCA	1519	-2.060	-43	1476	-21.01
MOZART3	1519	-1.426	-30	1489	-14.50
OsloCTM3	1519	-1.351	-29	1490	-13.94