Supporting Information

Effect of regional precursor emission controls on long-range ozone transport:

2. Steady-state changes in ozone air quality and impacts on human mortality

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Table S1 shows the normalized source-receptor relationships for steady-state ozone, per unit change in NO_x emissions, for all source receptor pairs. Results in Table S1 are similar to those for the short-term influences in (West et al., 2009), highlighting regions in the tropics and SH as having greater overall influences at steady state.

Table S2 shows the long-term change in ozone due to changes in CH_4, for all source-receptor pairs. Relative to the results in Table 1 for long-term ozone, Table S2 includes the spatial distribution of the long-term ozone response to CH_4, where for any source region, the influence is greatest for EU as a receptor (particularly for the summer period relevant for this three-month indicator) and least for EA. These results may be used in future studies to calculate the long-term effects of NO_x reductions from a particular continental region.

Table S3 compares estimates of avoided mortalities due to ozone long-range transport, with the estimates of Anenberg et al. (submitted) for the HTAP multimodel intercomparison, under similar conditions. The results show fewer estimated avoided mortalities in the present study, which is mainly due to model differences in the sensitivity of ozone to changes in precursor emissions (see West et al., 2009).

Table S4 shows the avoided annual premature mortalities at steady state per unit reduction in NO_x emissions, for all source-receptor pairs.

Table S5 shows the avoided annual premature mortalities at steady state for simultaneous reductions of NO_x, NMVOCs, and CO emissions from each of three regions.

Table S1 – Normalized source-receptor matrix for the steady-state change in 3-month population-weighted average ozone (Table 2) per Tg NO_x emission change (ppb $(TgN\ yr^{-1})^{-1}$). The diagonal, showing the effect of each region on itself, is underlined, while the largest off of the diagonal are bold.

		Receptor Region								
		NA	EU	FSU	AF	IN	EA	SA	SE	AU
Source Region	NA	0.62	0.06	0.04	0.04	0.04	0.00	0.00	0.00	-0.01
	EU	0.01	0.39	**0.38**	**0.14**	0.02	0.01	-0.01	0.00	-0.01
	FSU	0.04	**0.21**	1.61	0.05	0.05	0.10	-0.01	-0.01	-0.01
	AF	-0.02	-0.01	0.03	0.84	**0.21**	-0.03	0.01	0.00	0.05
	IN	-0.01	-0.06	-0.02	0.01	4.15	0.11	-0.02	**0.24**	-0.02
	EA	0.02	-0.01	0.02	0.00	0.00	2.32	-0.01	**0.25**	-0.01
	SA	-0.02	-0.14	-0.10	-0.05	-0.05	-0.09	3.00	-0.02	**0.34**
	SE	-0.12	-0.18	-0.13	-0.09	0.11	**0.49**	0.03	3.95	0.07
	AU	-0.11	-0.14	-0.10	-0.08	-0.11	-0.09	**0.26**	0.00	4.62

Table S2 – Normalized source-receptor matrix for the long-term change in 3-month population-weighted average ozone per Tg NO_x emission change (ppt $(TgN\ yr^{-1})^{-1}$).

		Receptor Region								
		NA	EU	FSU	AF	IN	EA	SA	SE	AU
Source Region	NA	18	23	17	19	19	14	15	15	14
	EU	9	11	8	9	9	6	7	7	7
	FSU	13	16	12	13	13	10	10	11	10
	AF	43	56	40	45	45	33	36	36	34
	IN	42	55	40	44	44	32	35	36	33
	EA	18	24	17	19	19	14	15	15	14
	SA	96	125	90	100	100	73	79	81	76
	SE	119	155	112	125	124	91	99	100	94
	AU	100	129	93	104	104	75	82	84	98

Table S3 – Comparison of avoided annual premature all-cause mortalities with estimates from the HTAP model intercomparison (Anenberg et al., submitted), in parenthesis. Results are shown for the HTAP receptor regions (see Fiore et al., 2009), but using source regions from this study, for 10% simultaneous reductions of anthropogenic NO_x, NMVOCs, and CO emissions from each region, for short-term results, and using no low-concentration threshold. Results from Anenberg et al. (submitted) for the multimodel ensemble mean are divided by two, as they modeled 20% reductions. The South Asia (SA) region of Anenberg et al. (submitted) corresponds to the IN region here.

		Receptor Region			
		NA	EU	IN	EA
Source	NA	145 (800)	561 (850)	292 (500)	278 (500)
	EU	62 (150)	-290 (1250)	251 (550)	151 (600)

Table S4 – Avoided annual premature all-cause mortalities at steady state (Table 8 of main paper) per Tg reduction in NO_x emissions (mortalities $(TgN\ yr^{-1})^{-1}$).

		Receptor Region									
		NA	EU	FSU	AF	IN	EA	SA	SE	AU	Global
Source Region	NA	29	15	6	9	7	6	1	-1	0	72
	EU	1	-62	18	**47**	4	8	0	0	0	15
	FSU	3	19	19	19	19	**31**	-1	-1	0	108
	AF	0	16	14	445	**45**	12	0	-1	0	531
	IN	6	2	4	20	2599	**53**	-1	**45**	0	2727
	EA	7	7	4	-3	17	282	-1	**30**	0	344
	SA	-10	-21	-10	-19	-39	-39	243	-5	1	100
	SE	-12	-23	-11	-30	**165**	**105**	0	627	0	821
	AU	-15	-23	-11	-44	-58	-44	8	8	19	-161
	Global										290

Table S5 – Avoided annual premature all-cause mortalities at steady state due to reductions in 10% of anthropogenic NO_x, NMVOCs, and CO emissions from each region.

		Receptor Region									
		NA	EU	FSU	AF	IN	EA	SA	SE	AU	Global
Source	NA	491	**244**	101	**273**	**209**	**218**	12	15	0	1564
	EU	52	84	179	**494**	126	**218**	2	16	0	1173
	SE	2	-3	-1	29	177	114	5	462	0	784