SUPPLEMENTAL MATERIAL

Impacts of global, regional, and sectoral black carbon emission reductions on surface air quality and human mortality

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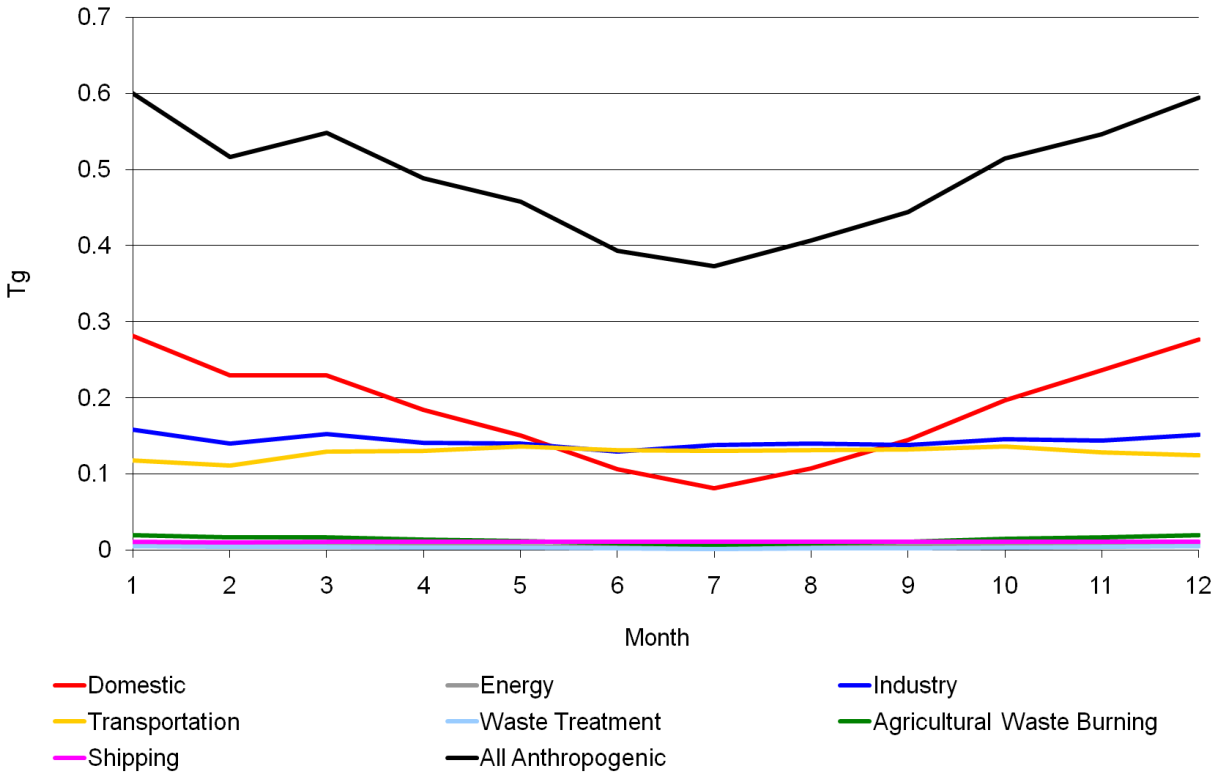

Fig. S1. Monthly variation of global BC emissions by sector, according to monthly variation of CO from RETRO inventory.

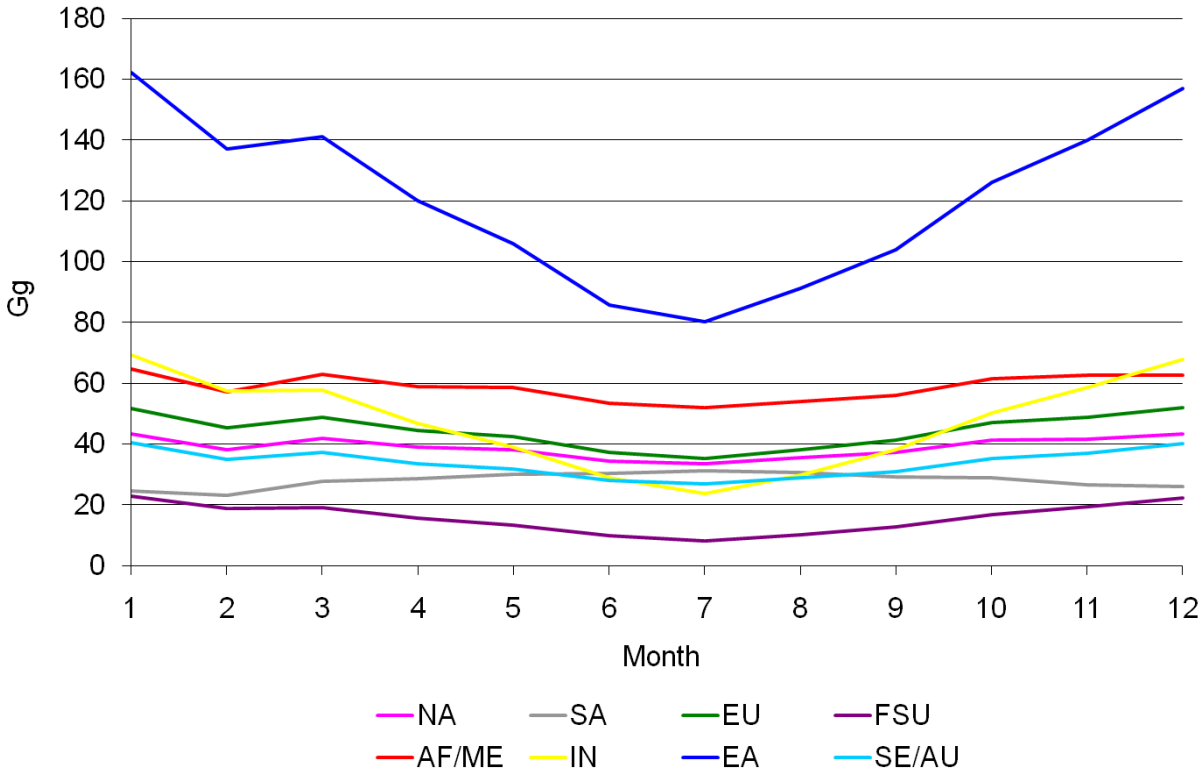

Fig. S2. Monthly anthropogenic BC emissions by region, according to monthly variation of CO from RETRO inventory.

Table S1. Total global emissions of relevant species for base case year 2002, in Tg(species)/year. NO_x ($NO+NO_2$) emissions are reported as NO.

Species	Emissions
BC	8.6
OC	41.2
NO_x	93.6
SO_2	149.5

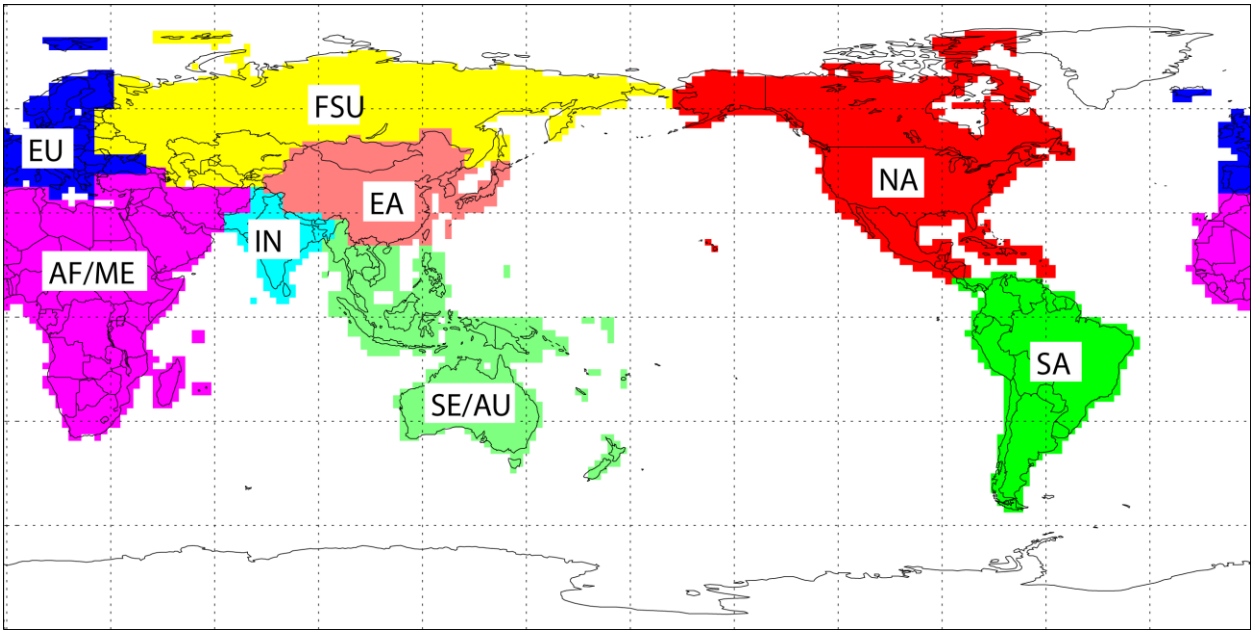

Fig. S3. Regional definitions, gridded to MOZART-4 grid.

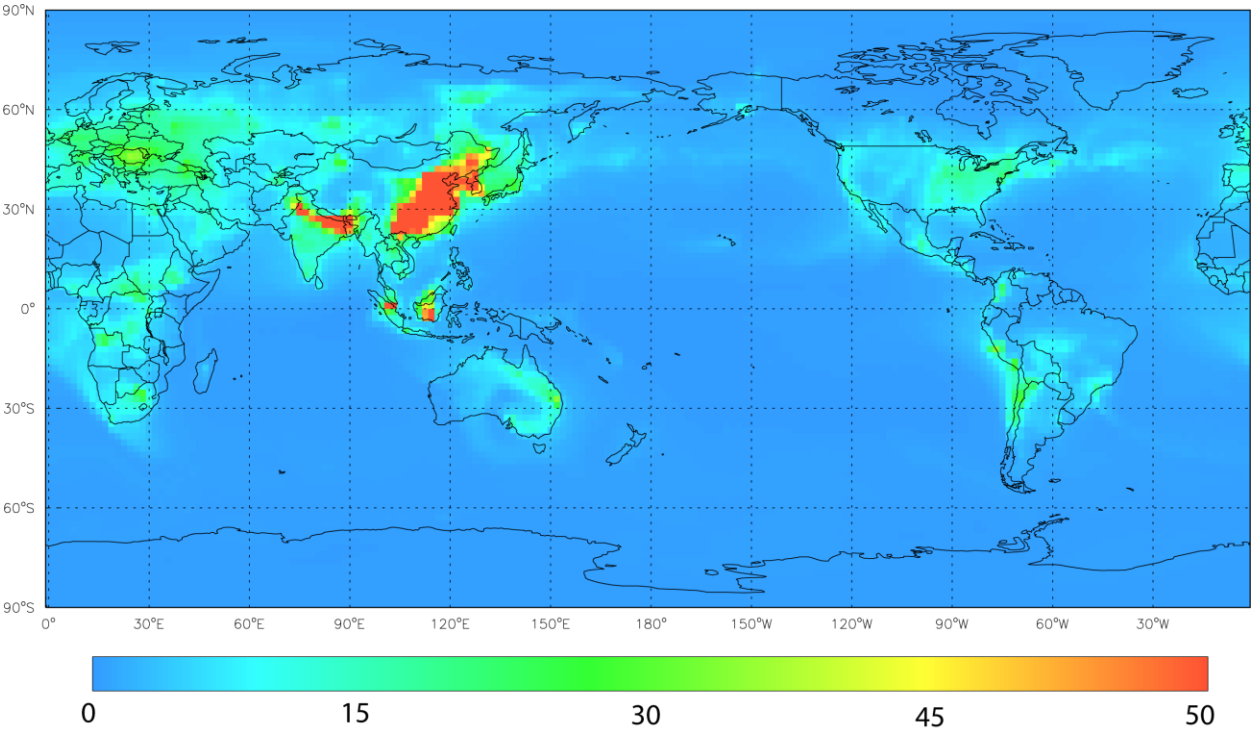

Fig. S4. Annual average concentration (μg/m^3) of total $PM_{2.5}$ for the 2002 base case

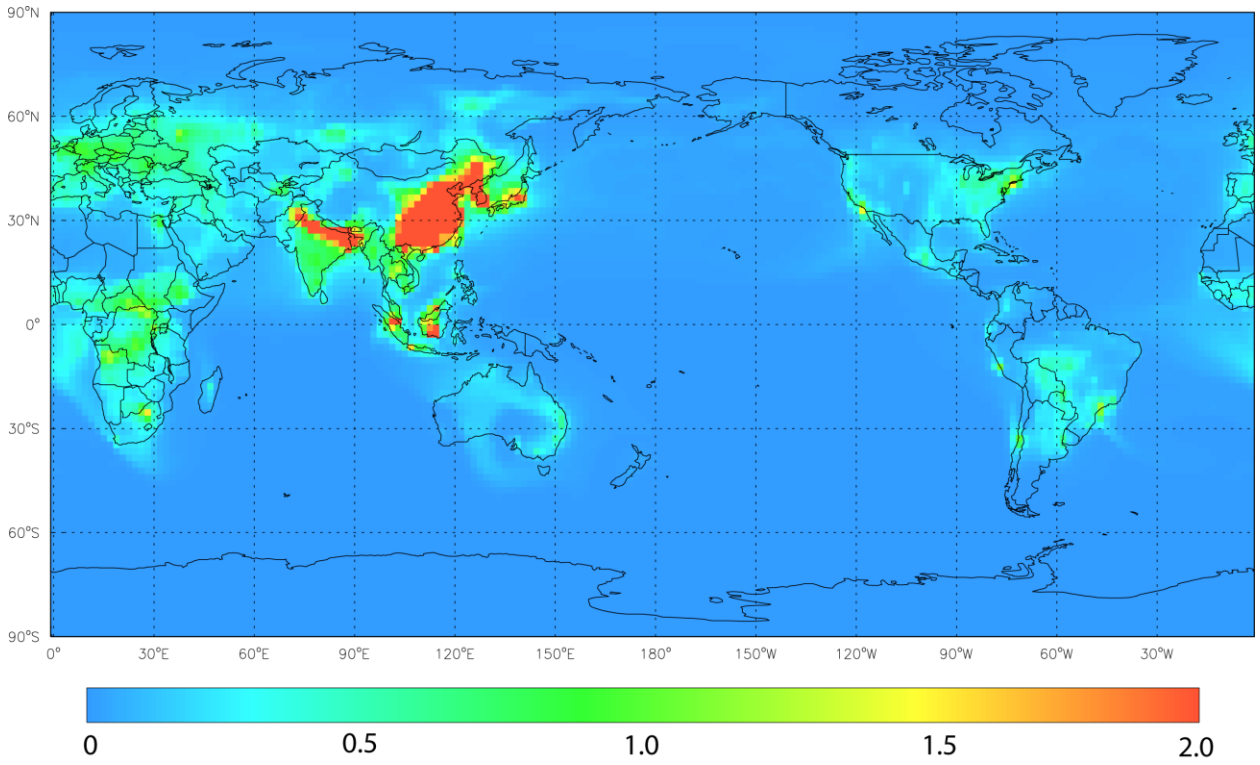

Fig. S5. As Fig. S4, but for BC

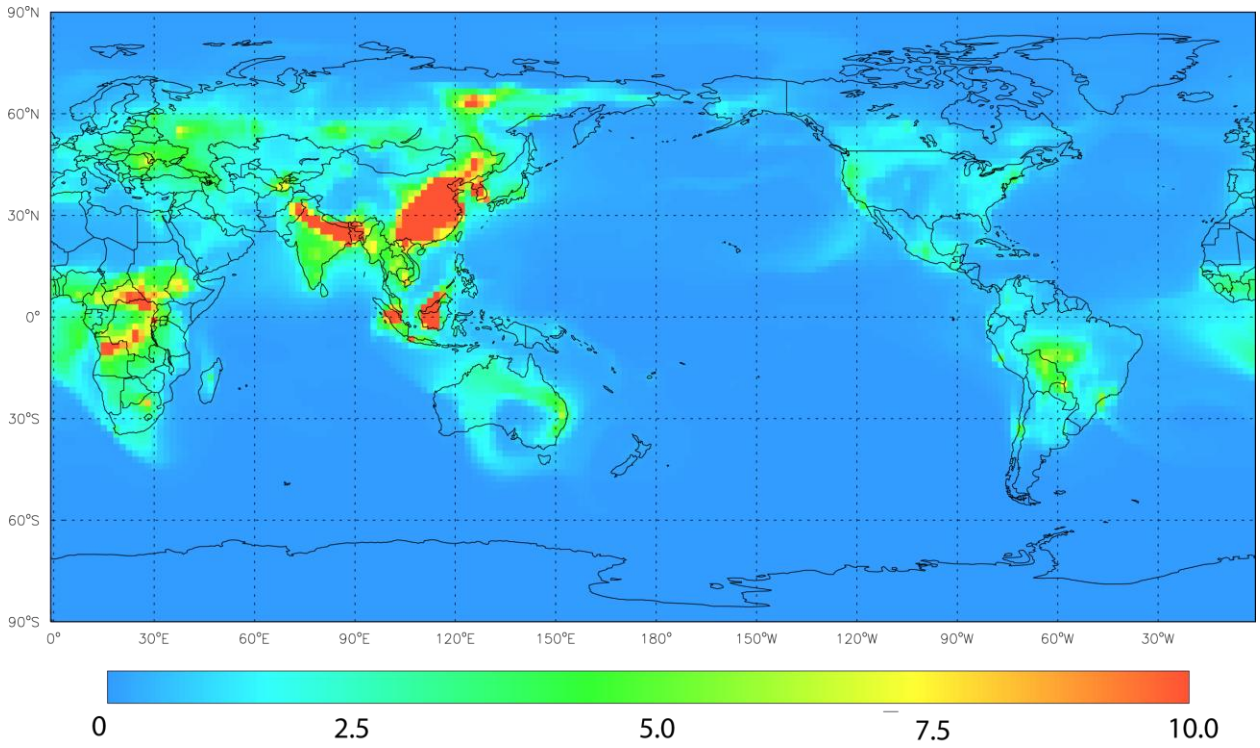

Fig. S6. As Fig. S4, but for OM (includes SOA)

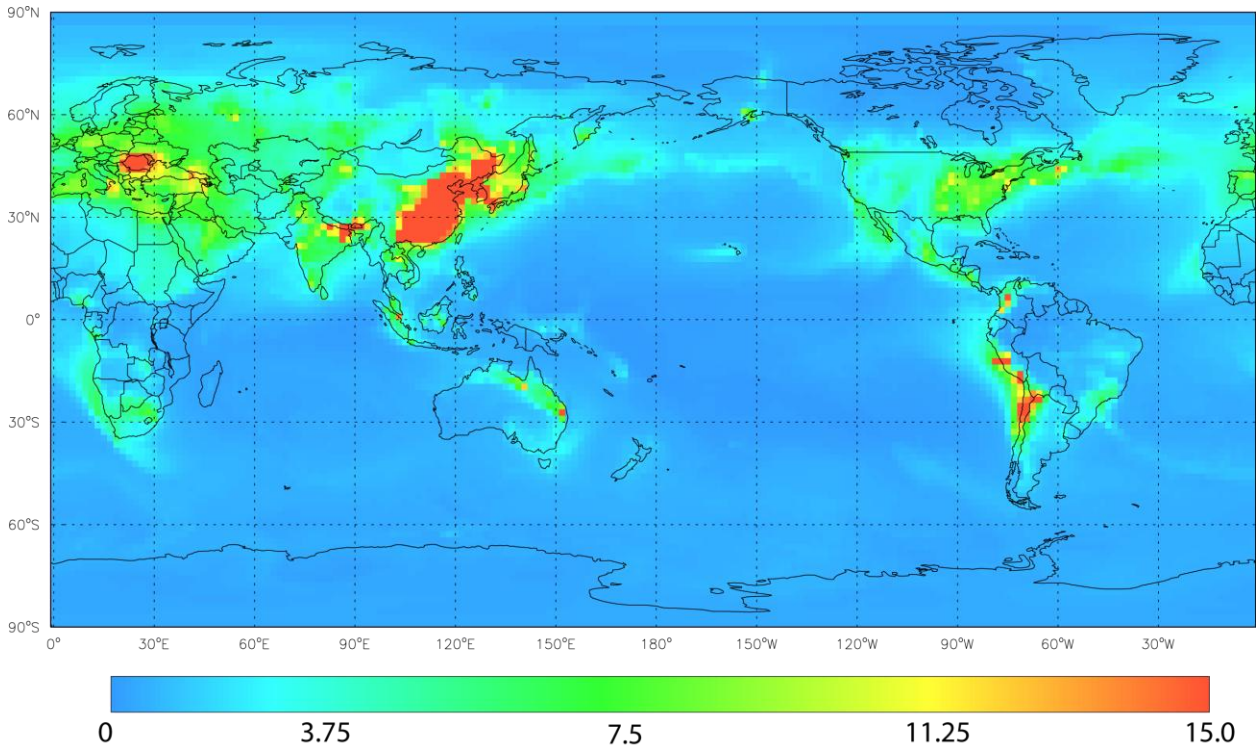

Fig. S7. As Fig. S4, but for SO_4

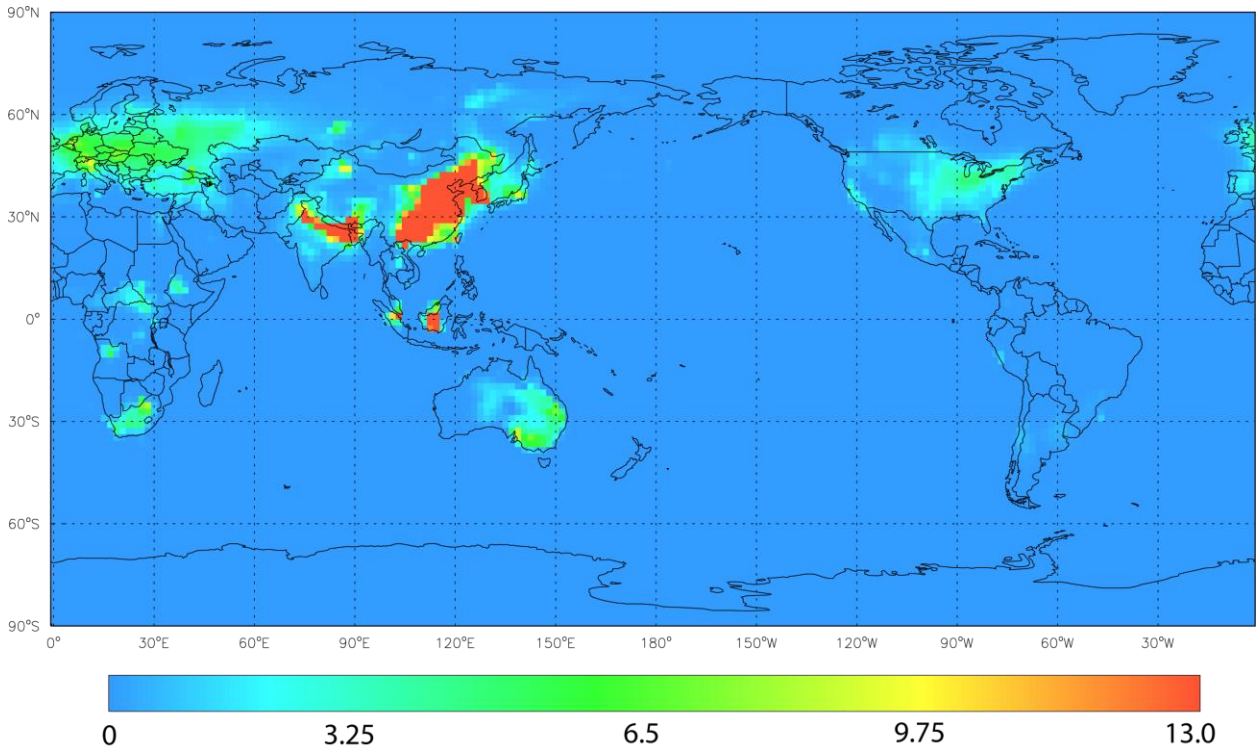

Fig. S8. As Fig. S4, but for NO_3

Table S2. Simulated simple and population-weighted regional average base case concentrations of BC, OM, SO_4, and NO_3 ($\mu g/m^3$).

	BC		OM		SO_4		NO_3	
Region	Simple Average	Population-weighted Average	Simple Average	Population-weighted Average	Simple Average	Population-weighted Average	Simple Average	Population-weighted Average
NA	0.11	0.36	0.76	1.54	2.26	5.07	0.41	1.32
SA	0.15	0.31	1.36	1.75	2.28	3.84	0.05	0.13
EU	0.36	0.54	1.41	1.86	5.86	7.20	2.14	3.79
FSU	0.17	0.45	1.64	3.27	3.31	6.11	0.74	2.47
AF/ME	0.26	0.39	2.09	2.99	2.68	3.31	0.30	0.53
IN	0.99	1.75	6.33	11.32	5.66	8.08	6.31	15.14
EA	1.28	3.46	5.61	14.35	10.45	21.70	10.65	30.64
SE/AU	0.23	0.66	2.19	4.81	1.62	3.06	0.78	1.02
World	0.10	1.46	0.68	7.42	1.52	9.39	0.45	11.43

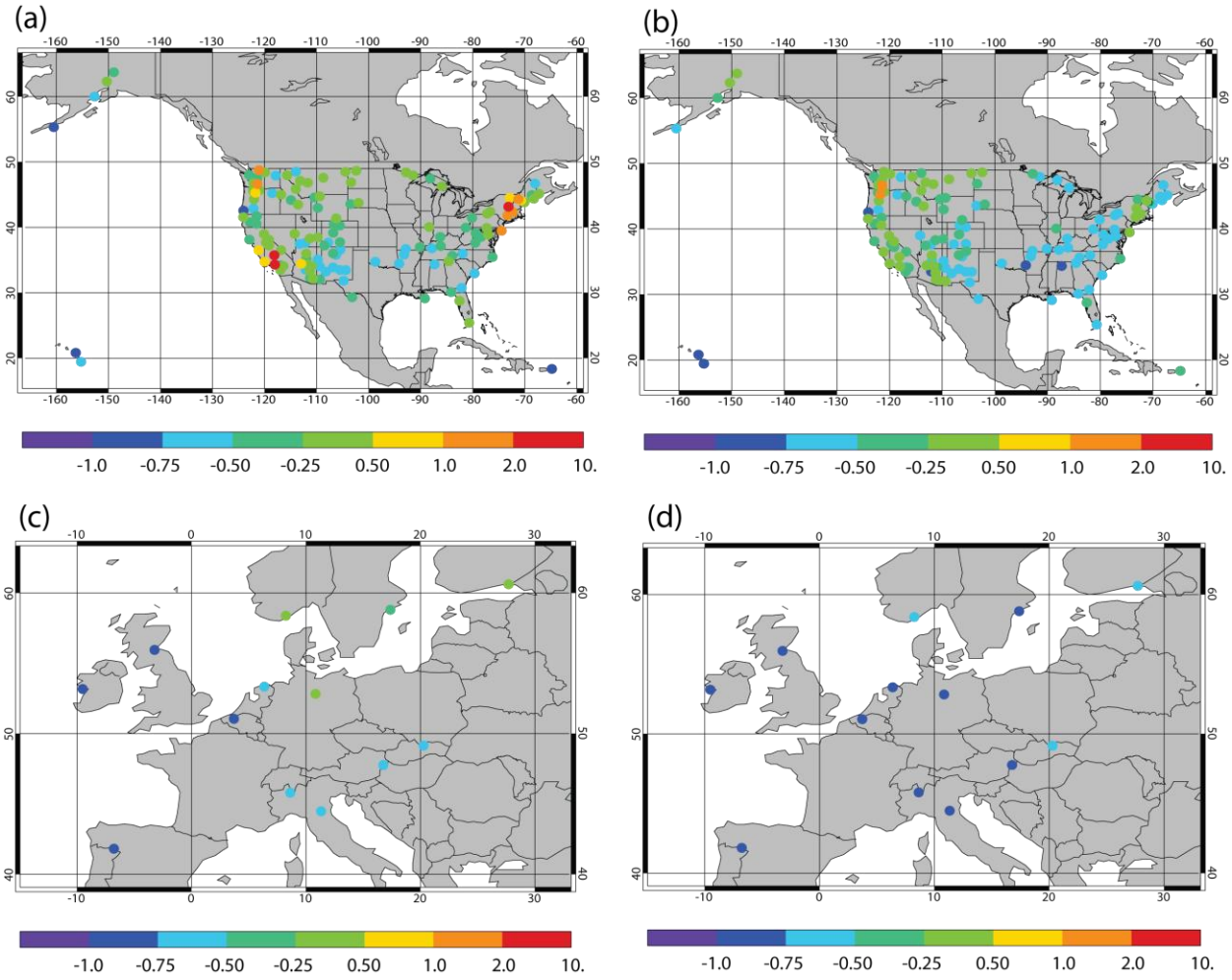

Fig. S9. As Fig. 3, but plotted on a spatial map to show a comparison of modeled and measured concentrations [(modeled-observed)/observed] in μg/m^3.

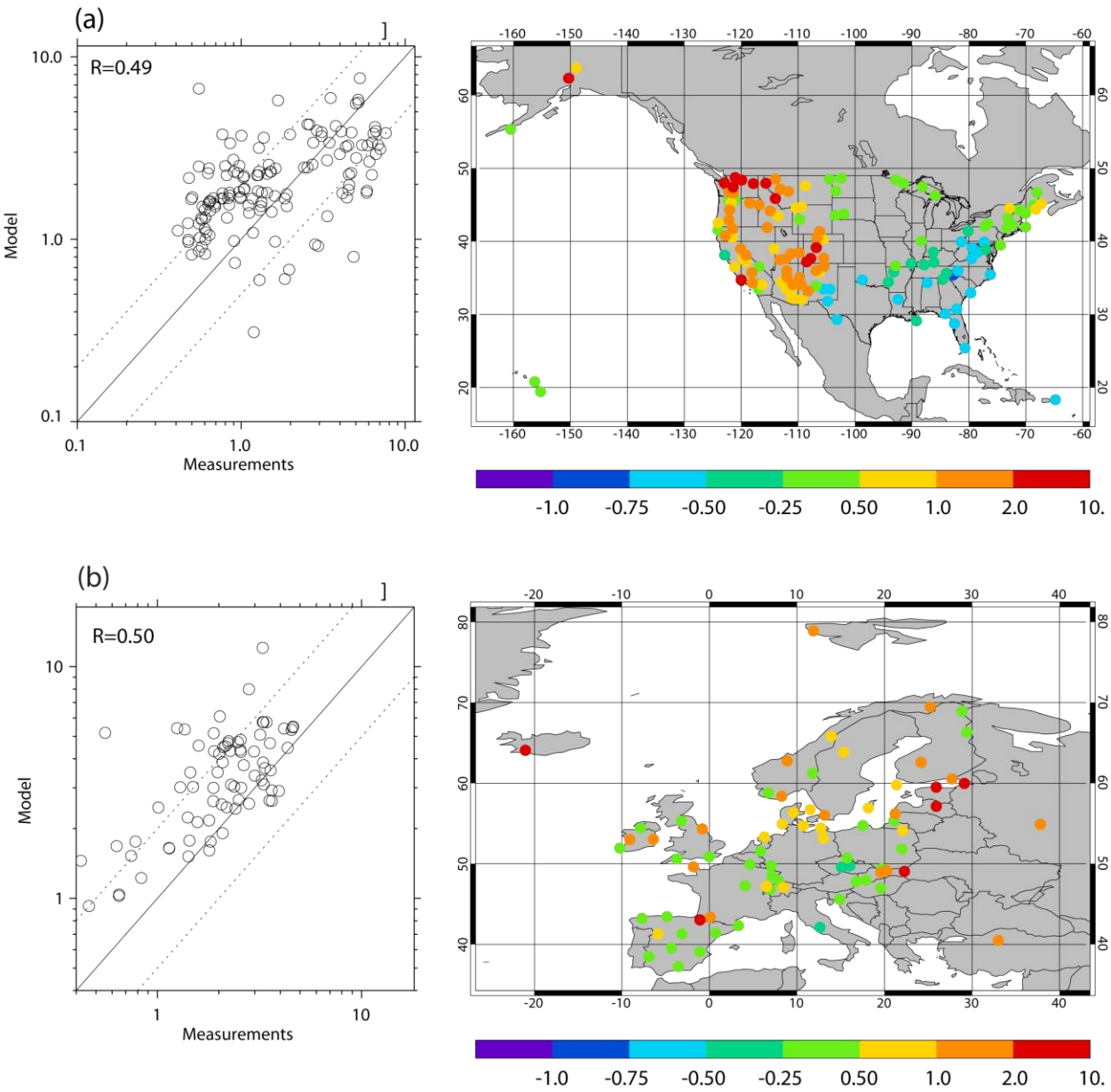

Fig. S10. Comparison of simulated annual average surface SO_4 concentrations with the IMPROVE surface monitoring network for remote locations in the United States and with the EMEP surface monitoring network for Europe (average 2002-2003). The panels on the right show a comparison of modeled and measured concentrations [(modeled-observed)/observed] in $\mu g/m^3$.

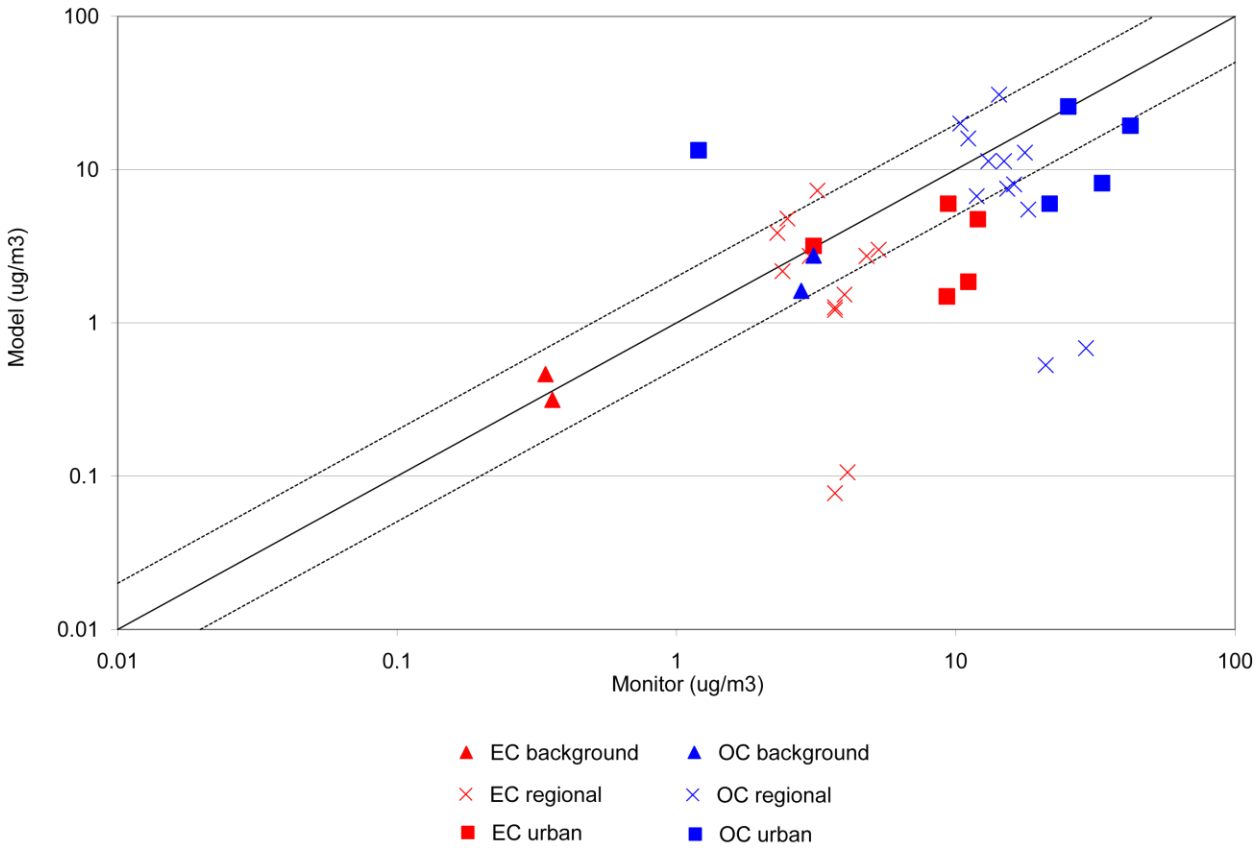

Fig. S11. Comparison of modeled annual average (2002) BC and OC with observed annual average EC and OC at 15 sites in China in 2006 (Zhang et al., 2009).

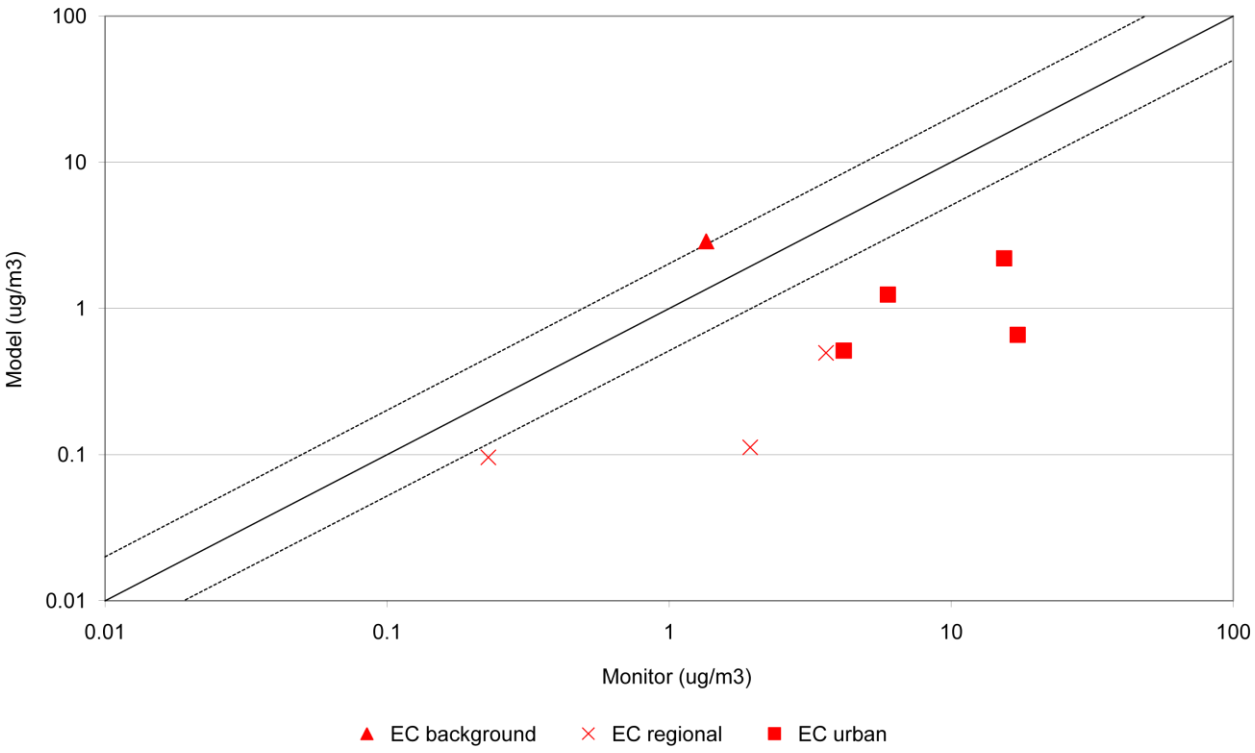

Fig. S12. Comparison of modeled annual average BC (2002) with observed EC in India for the pre-monsoon season (average January-May) at eight sites in India in 2006 (Beegum et al., 2009).

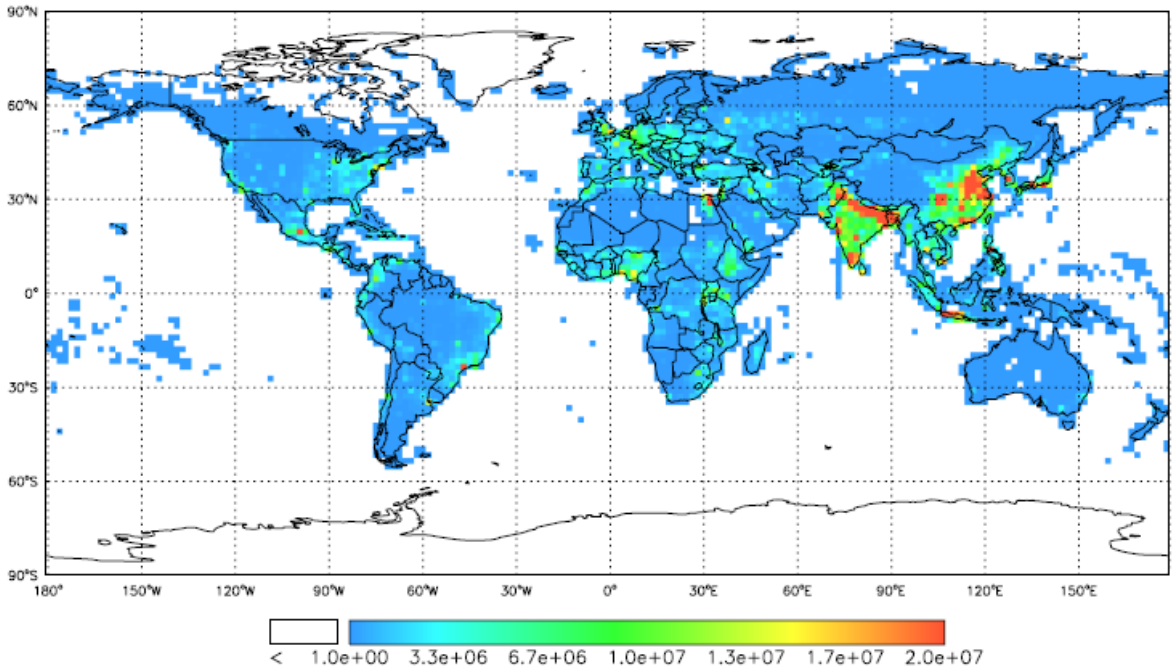

Fig. S13. 2006 population from Landscan database (Oak Ridge National Laboratory, 2008) aggregated to MOZART-4 grid.

Table S3. Population aged 30 and older, baseline total (for all population), cardiopulmonary (for the population ≥30), and lung cancer (for the population ≥30) mortality rates, and simulated simple and population-weighted average $PM_{2.5}$ concentrations ($\mu g/m^3$) for the 2002 base case, for each region.

Region	Population 30+	Baseline Mortality Rates (% per year) All-cause	Cardio-pulmonary (30+)	Lung Cancer (30+)	Base Case $PM_{2.5}$ Concentration Range ($\mu g/m^3$)
NA	2.70E+08	0.723	0.488	0.072	0.32 - 17.82
SA	1.50E+08	0.615	0.500	0.024	0.64 - 28.63
EU	3.46E+08	1.000	0.735	0.061	1.08 - 29.87
FSU	1.66E+08	1.514	1.421	0.055	0.57 - 27.49
AF/ME	3.59E+08	1.206	0.746	0.014	0.40 - 23.71
IN	5.87E+08	0.919	0.835	0.026	1.69 - 185.36
EA	8.03E+08	0.741	0.679	0.046	2.26 - 233.65
SE/AU	2.61E+08	0.599	0.490	0.040	0.11 - 86.89
World	2.94E+09	0.858	0.676	0.038	0.10 - 233.65

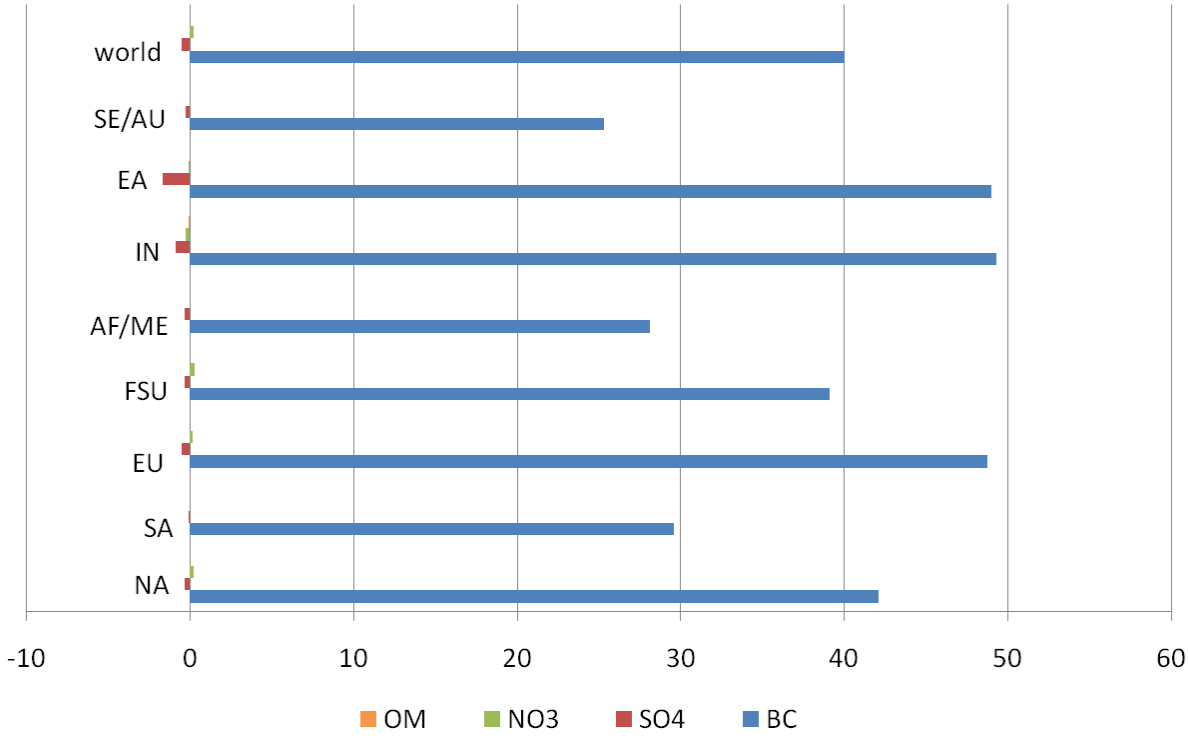

Fig. S14. Percentage reduction in annual average concentrations (ng/m^3) of $PM_{2.5}$ species for halving global anthropogenic BC emissions relative to the base case.

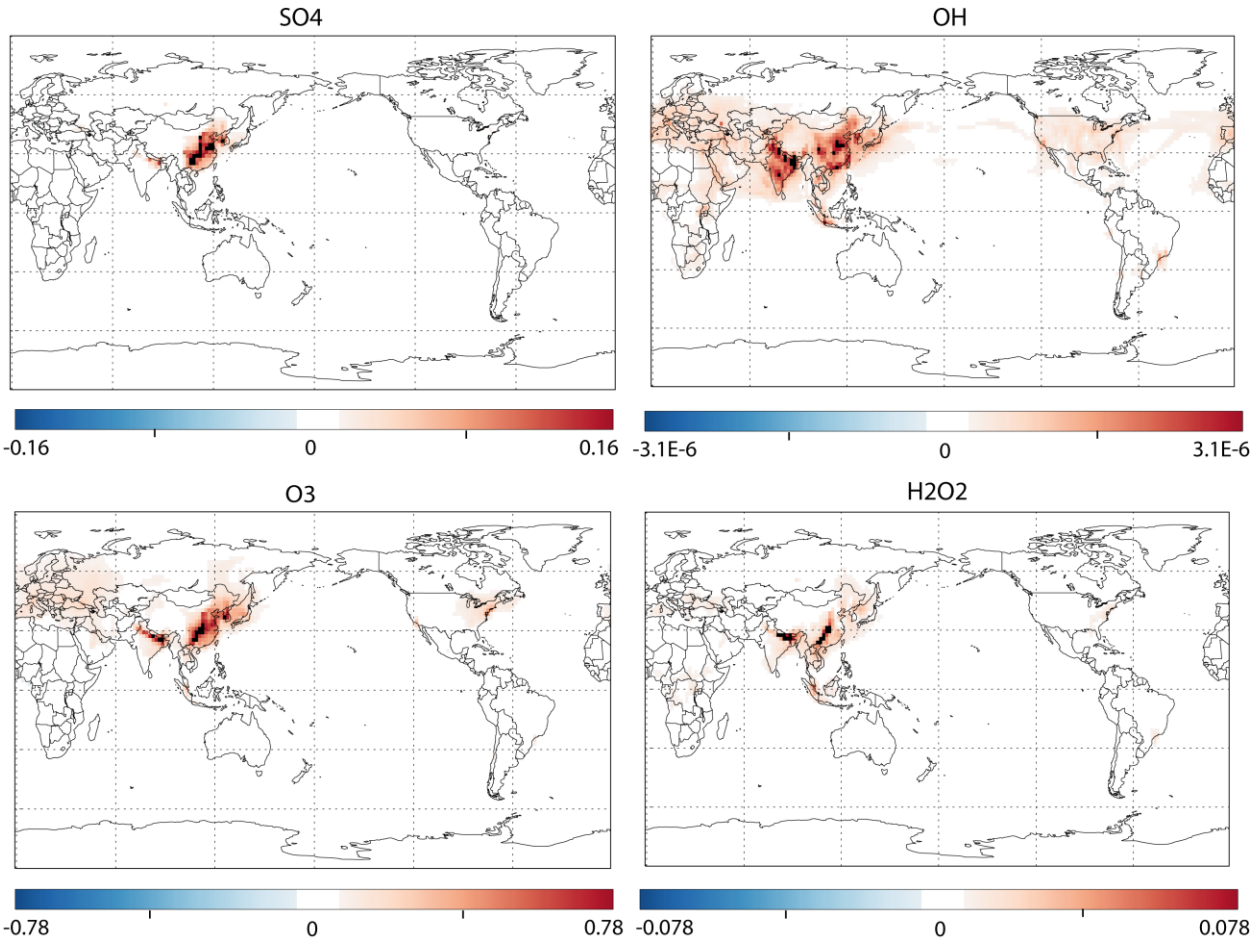

Fig. S15. Change in annual average surface SO_4, OH, O_3, and H_2O_2 concentrations (ppb) for halving global anthropogenic BC emissions relative to the base case.

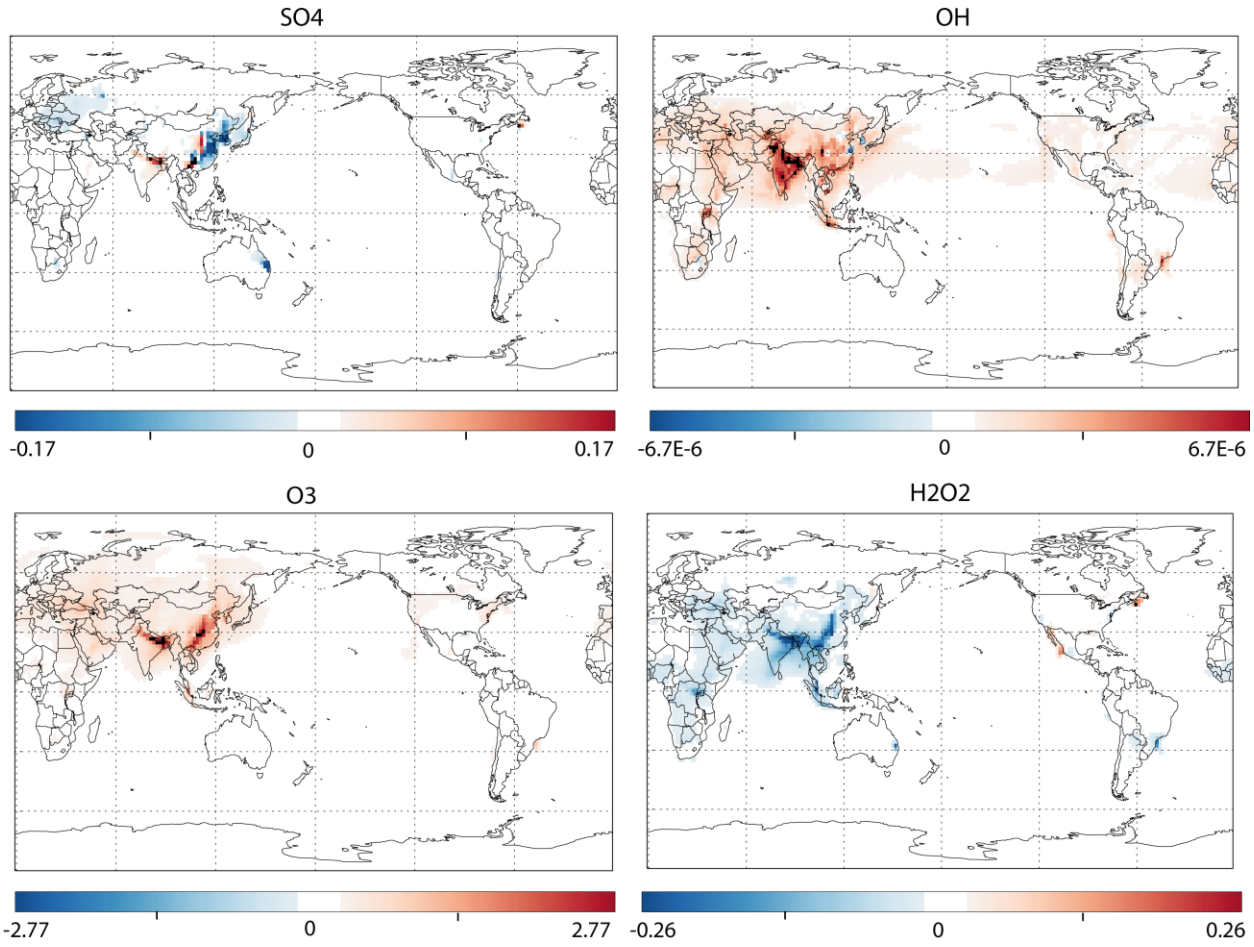

Fig. S16. As Fig. S15 but for halving global anthropogenic BC+OC emissions.

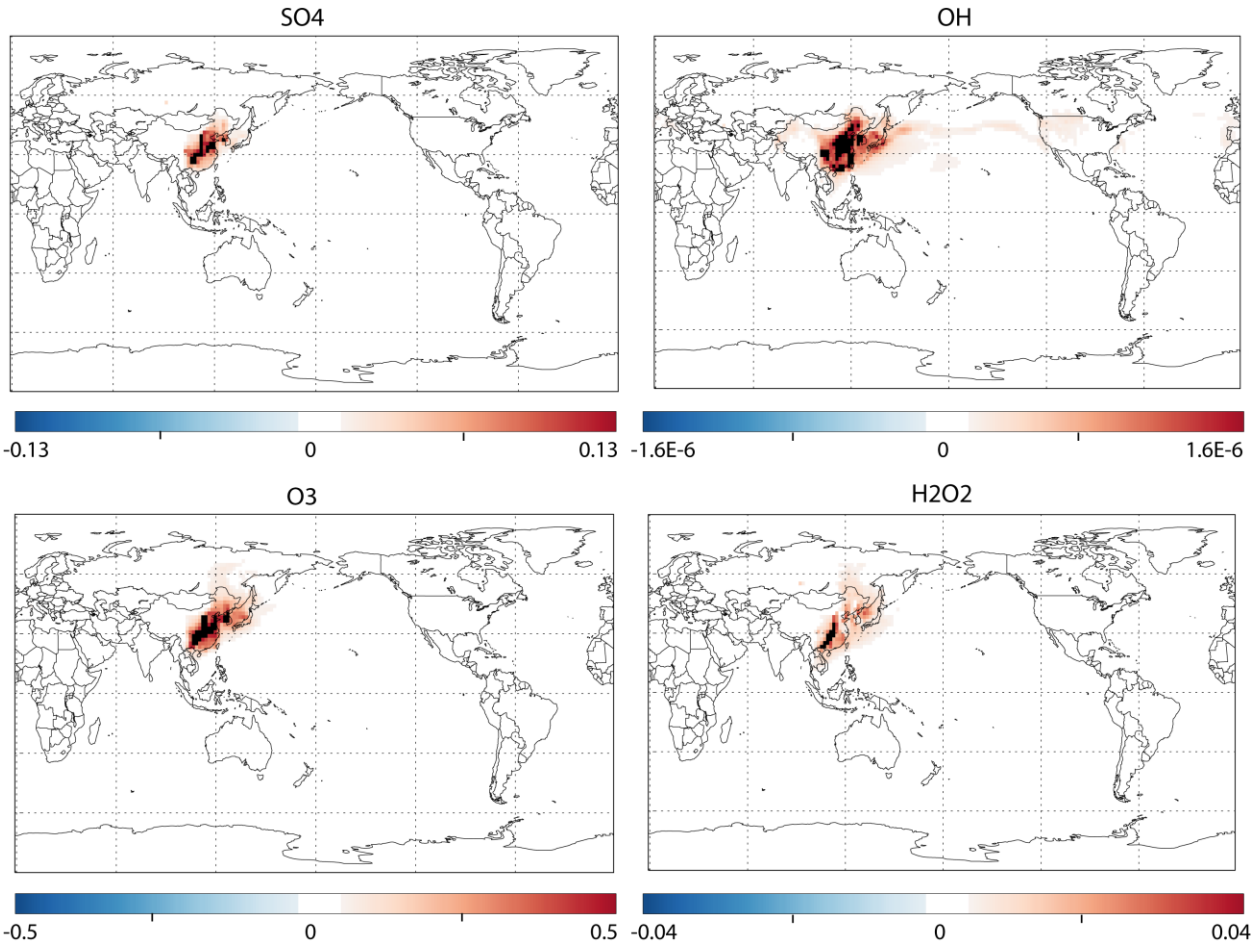

Fig. S17. As Fig. S15 but for halving anthropogenic BC emissions in EA only.

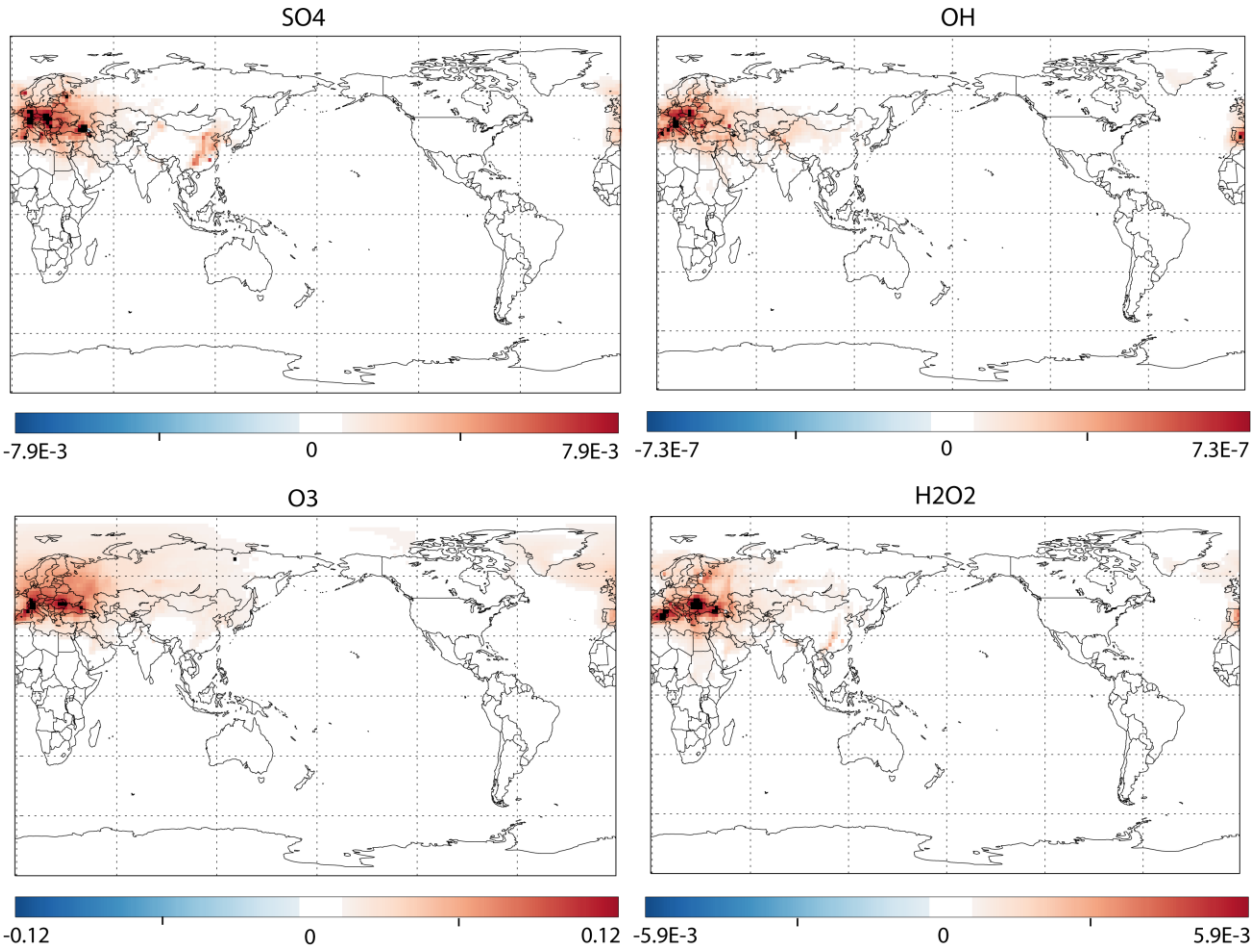

Fig. S18. As Fig. S15 but for halving anthropogenic BC emissions in EU only.

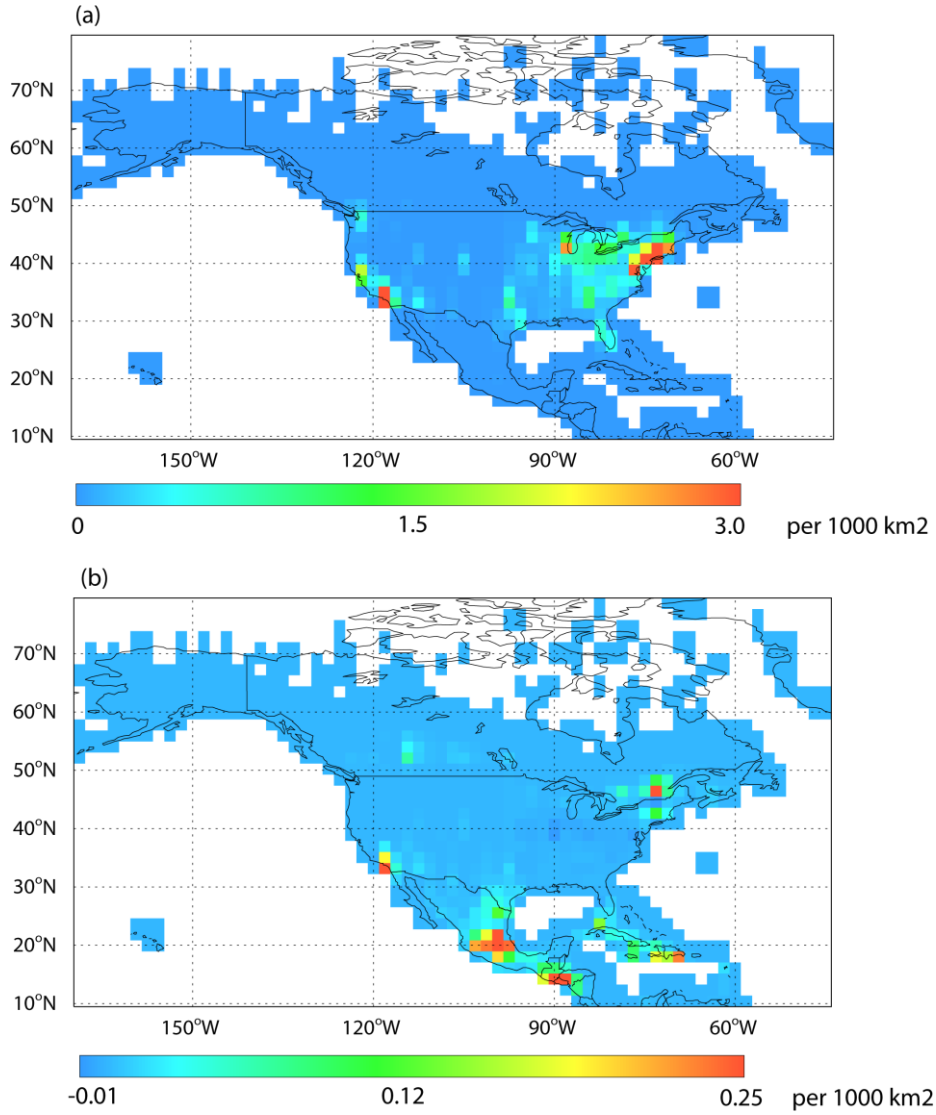

Fig. S19. (a) Avoided premature deaths from halving US anthropogenic BC emissions relative to the base case, and (b) difference in avoided deaths from halving BC emissions in NA vs. the US only (NA reduction minus US reduction).

References

Beegum, S. N., Moorthy, K. K., Babu, S. S., Satheesh, S. K., Vinoj, V., Badarinath, K. V. S., Safai, P. D., Devara, P. C. S., Singh, S., Vinod, Dumka, U. C., and Pant, P.: Spatial distribution of aerosol black carbon over India during pre-monsoon season, Atmospheric Environment, 43, 1071-1078, 2009.

Oak Ridge National Laboratory: LandScan Global Population Database 2006, available at: http://www.ornl.gov/sci/landscan/index.html, 2008.

Zhang, X. Y., Wang, Y. Q., Zhang, X. C., Guo, W., and Gong, S. L.: Carbonaceous aerosol composition over various regions of China during 2006, J. Geophys. Res., 113, D14111, doi:10.1029/2007JD009525, 2008.