

Fig. S1

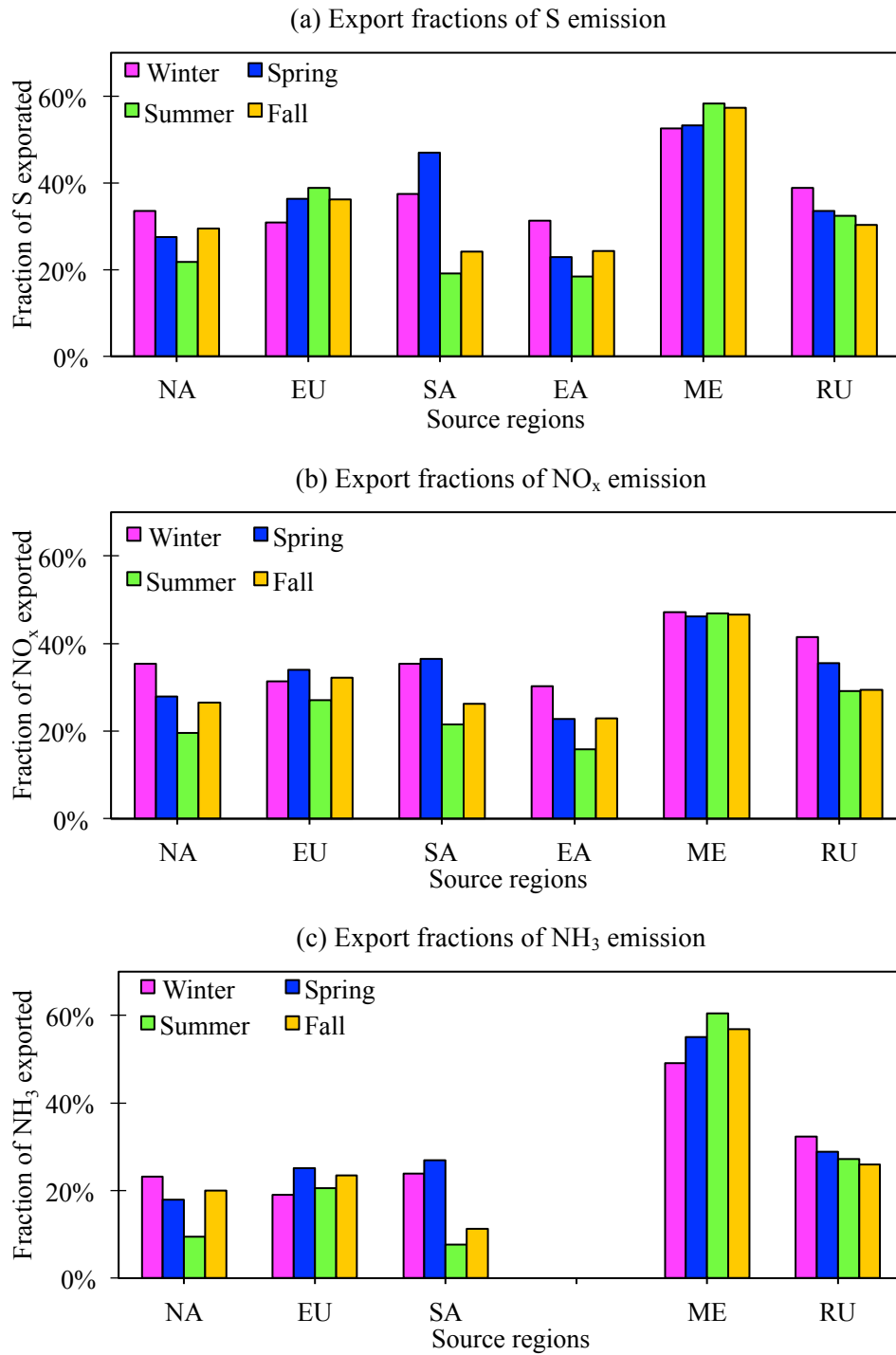


Fig. S1 Export fractions of S, NO<sub>x</sub> and NH<sub>3</sub> emissions from source region in four seasons.

Fig. S2

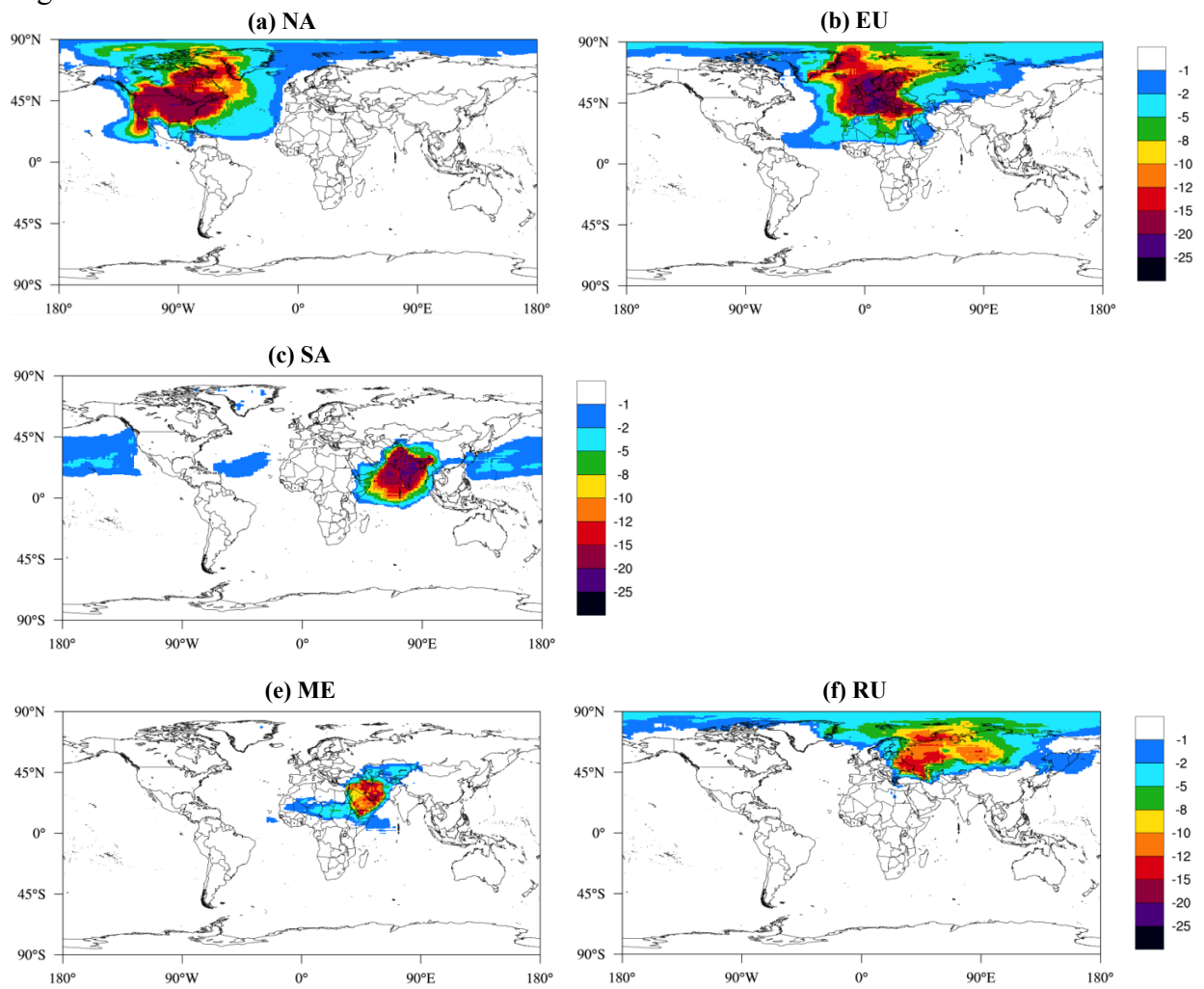


Fig. S2 The response of  $\text{NH}_x$  deposition to 20% emission reduction in source regions. The values are the percentage changes (%) in deposition calculated as  $(\text{changes in deposition with 20\% emission reduction}) / (\text{base case deposition}) \times 100\%$ . The unit is %.

Fig. S3

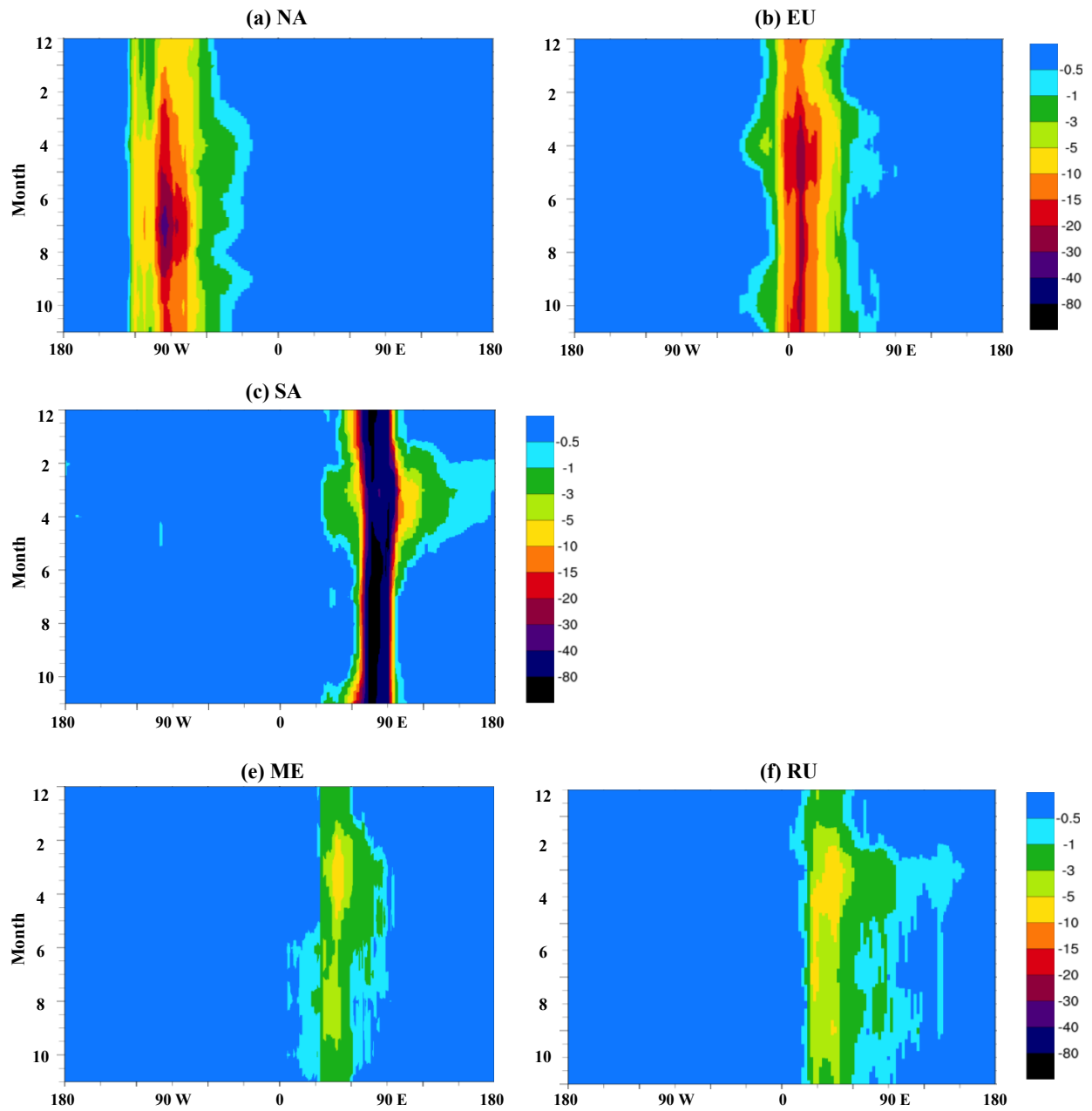


Fig. S3 The monthly changes of  $\text{NH}_x$  deposition with 20% emission reduction in source regions. The values are meridional total values versus time with a west-east resolution of 0.1 degree. The unit is  $\times 10^4 \text{ kg(N) month}^{-1}$ . The negative values indicate decline in deposition.

Fig. S4

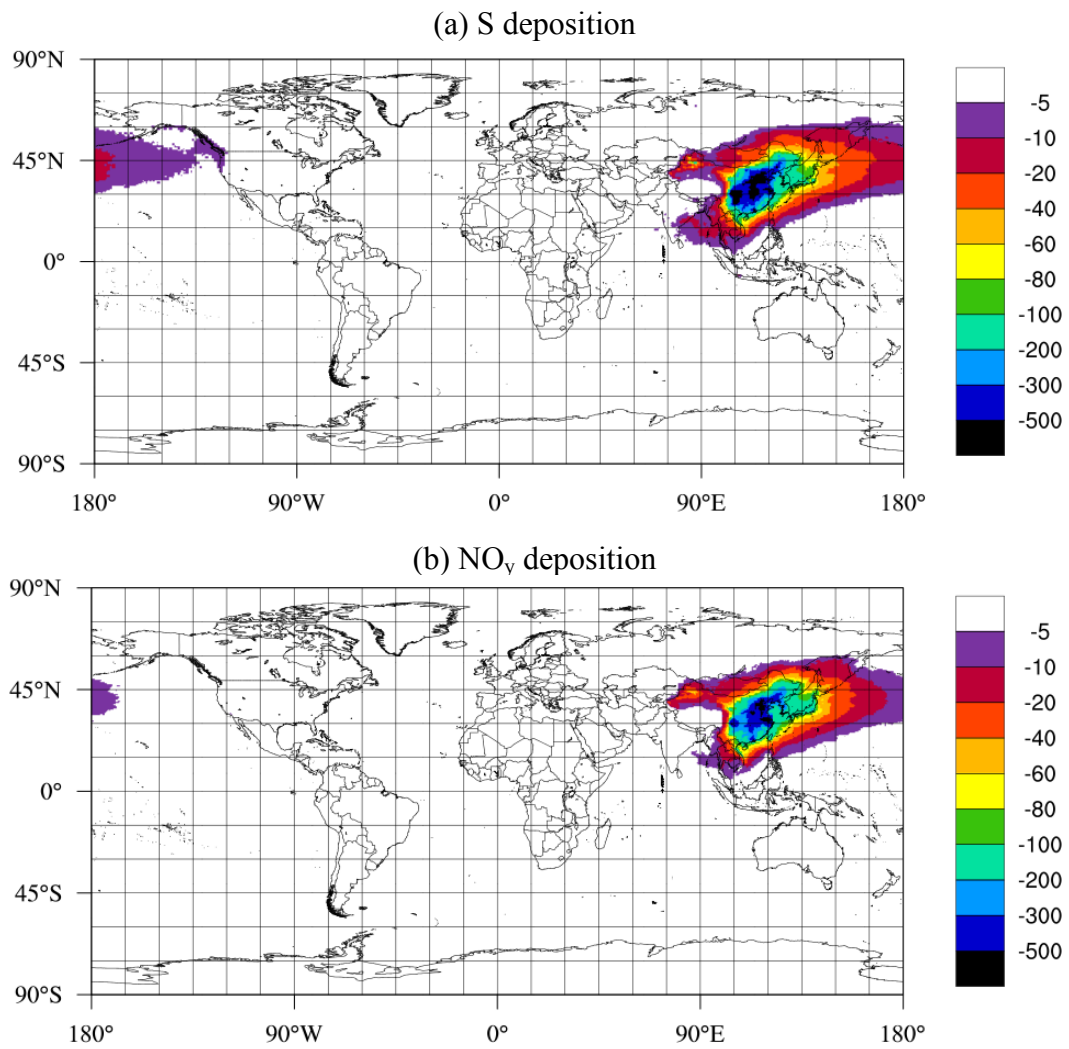


Fig. S4 Changes of S and NO<sub>y</sub> deposition under 20% emission reduction in EA (unit: mg (S or N) m<sup>-2</sup> yr<sup>-1</sup>)

Table S1

Table S1. Global changes of emission and deposition under emission perturbation experiments  
(unit: Tg (S or N) yr<sup>-1</sup>)

		Regions of emission perturbation						
		NA	EU	SA	EA	MD	RU	GLO
S	Δ Emis	-1.2	-0.7	-1.1	-2.9	-0.7	-0.5	-10.5
	Δ Depo	-1.1	-0.6	-1.0	-2.8	-0.6	-0.4	-10.1
NO <sub>y</sub>	Δ Emis	-0.9	-0.6	-0.7	-1.8	-0.3	-0.3	-7.0
	Δ Depo	-0.9	-0.6	-0.6	-1.8	-0.3	-0.2	-6.8
NH <sub>x</sub>	Δ Emis	-0.7	-0.7	-2.1	-1.6	-0.1	-0.2	-8.0
	Δ Depo	-0.7	-0.7	-2.2	-*	-0.1	-0.2	-8.2

\* Lack of NH<sub>4</sub><sup>+</sup> wet deposition under EA emission perturbation experiment from all models.

Table S2

Table S2. Median deposition fluxes under base case and under 20% emission perturbation in  
source regions (unit: mg (S/N) m<sup>-2</sup> yr<sup>-1</sup>)

	Receptor Regions	Base case	Source regions					
			NA	EU	SA	EA	ME	RU
Median S Deposition	NA	112.6	99.3	112.3	112.3	110.5	112.3	112.5
	EU	338.2	336.9	297.5	338.2	337.7	337.9	333.4
	SA	641.4	640.7	640.2	533.8	638.7	635.7	641.2
	EA	331.1	331.1	330.0	321.7	286.3	329.1	328.4
	ME	221.8	221.6	219.7	221.3	221.6	191.4	221.3
	RU	184.8	184.6	182.1	184.7	180.0	183.9	170.7
Median NO <sub>y</sub> Deposition	NA	138.3	122.4	138.2	138.2	137.6	138.3	138.3
	EU	347.2	346.4	310.7	347.1	346.8	346.8	342.2
	SA	565.2	565.0	565.2	492.0	563.5	562.3	565.1
	EA	213.3	213.0	213.0	210.0	188.6	212.9	212.9
	ME	197.2	196.8	195.3	196.6	196.9	172.6	197.0
	RU	102.8	102.6	101.6	102.8	99.9	102.5	96.1
Median NH <sub>x</sub> Deposition	NA	109.4	94.7	109.3	109.1	-	109.3	109.3
	EU	354.1	353.7	294.8	353.8	-	352.3	350.7
	SA	1638.0	1637.8	1637.4	1329.7	-	1636.8	1637.5
	EA	255.2	255.1	254.4	245.2	-	254.1	254.3
	ME	63.7	63.6	63.0	62.1	-	57.1	63.4
	RU	93.7	93.6	91.5	93.6	-	93.5	86.3

Table S3

Table S3. Changes of emission under emission perturbation experiments for 4 seasons (unit: Tg (S or N) month<sup>-1</sup>).

Emission changes	Seasons	Regions of emission perturbation					
		NA	EU	SA	EA	ME	RU
S	Winter	-0.090	-0.062	-0.084	-0.250	-0.049	-0.045
	Spring	-0.095	-0.058	-0.085	-0.226	-0.046	-0.039
	Summer	-0.100	-0.044	-0.080	-0.222	-0.042	-0.033
	Fall	-0.096	-0.049	-0.082	-0.231	-0.045	-0.038
NO <sub>x</sub>	Winter	-0.070	-0.042	-0.052	-0.142	-0.023	-0.023
	Spring	-0.073	-0.044	-0.052	-0.139	-0.023	-0.022
	Summer	-0.077	-0.039	-0.051	-0.140	-0.021	-0.019
	Fall	-0.073	-0.041	-0.051	-0.141	-0.023	-0.021
NH <sub>3</sub>	Winter	-0.039	-0.048	-0.201	-0.114	-0.010	-0.017
	Spring	-0.067	-0.079	-0.206	-0.149	-0.018	-0.032
	Summer	-0.097	-0.059	-0.206	-0.195	-0.012	-0.020
	Fall	-0.063	-0.062	-0.203	-0.140	-0.010	-0.018