Supplement of

Estimating global ammonia (NH₃) emissions based on IASI observations from 2008 to 2018

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Supplementary

Table S1. Uncertainty and sensitivity analyses of top-down NH₃ emissions. Annual averaged NH₃ emissions are summed over global land areas for 2008–2018.

	Parameter perturbed	Average emission (Tg a^{-1})
0	TDE[a]	79
1	Halved lifetime[b]	96
2	Doubled lifetime[c]	71
3	Upper IASI column error	84
4	Lower IASI column error	75
5	Number of retrievals > 400[d]	84
6	Number of retrievals > 1200[e]	76
7	Transport/Emission < 0.2[f]	74
8	Transport/Emission < 5[g]	86

[a]Excluding a grid cell if retrieval number is less than 800 during a month, or transport dominates over emissions or depositions in the simulated monthly NH₃ budget.

[b-c]The lifetime is 50 % and 200 % of values from Eq. (1), respectively.

[d-e]Monthly retrieval number threshold for including a grid cell is set to be 400 and 1200, respectively.

[f-g]Local budget ratio the threshold for including a grid cell is set to be 0.2 and 5, respectively.

Table 2. Consistency evaluation of simulated NH₃ concentrations against IASI observations using full-chemistry simulations driven by different emission datasets (BUE1 and TDE) in 2008, 2013 and 2018.

Year	number of grids	Emission	R^2	RMSE[a]	FB

		TDE	0.32	12.44	0.18
2008	9971	BUE1	0.40	7.83	-0.30
		TDE	0.54	7.34	0.08
2013	8957	BUE1	0.37	8.02	-0.19
		TDE	0.62	8.54	0.08
2018	8599	BUE1	0.31	10.55	-0.32

[a]In 10^{-5} mol m^{-2}.

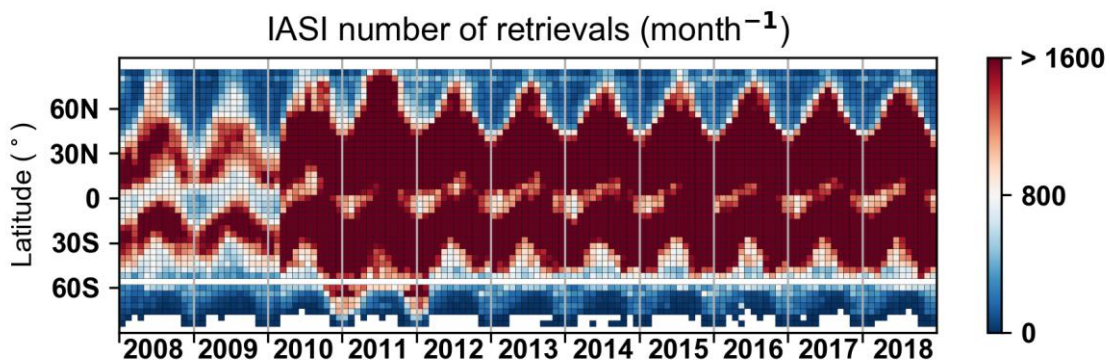



Figure S1. Number of satellite retrievals by latitude and by month during 2008-2018.

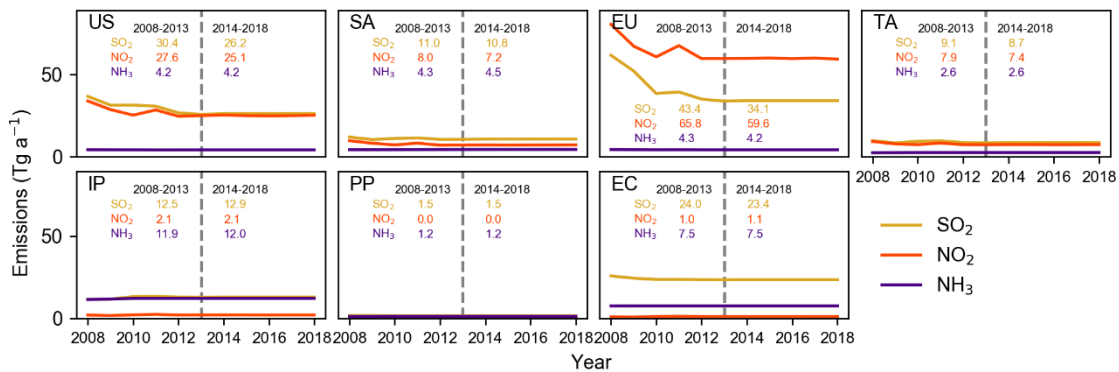
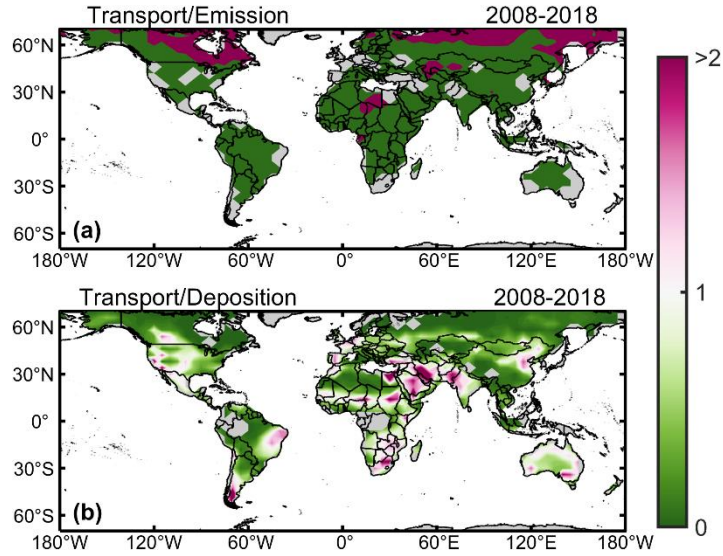



Figure S2. Annual anthropogenic emissions of NH$_3$, NO$_2$ and SO$_2$ from BUE1 for seven selected regions between 2008-2018. Average annual emissions (Tg a^{-1}) for 2008-2013 and 2014-2018 are inset.

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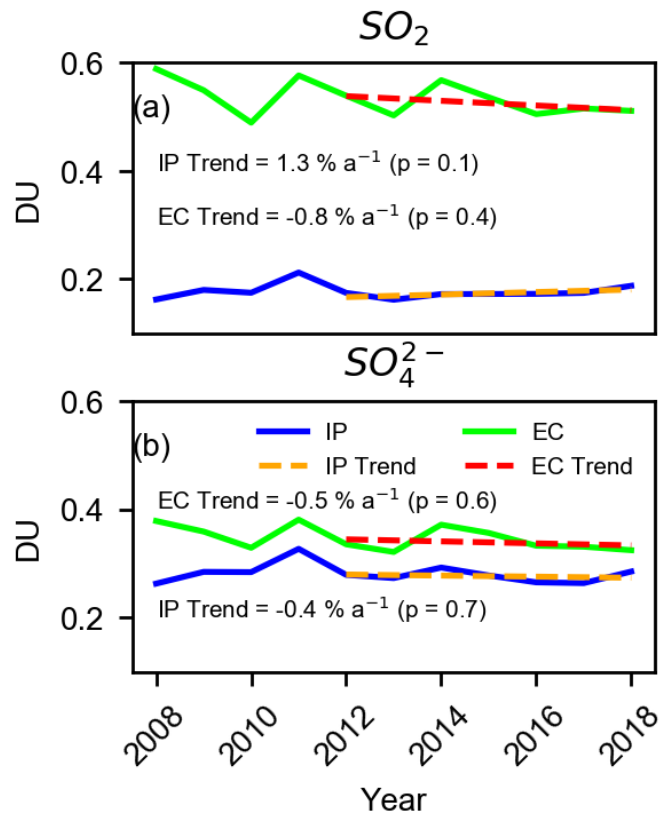
25 **Figure S3.** Spatial distribution of (a) positive transport to emission and (b) negative transport to deposition ratios

26 during 2008-2018.

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28 **Figure S4.** Annual average of simulated (a) SO_2 and (b) SO_4^{2-} over IP and EC (two regions in Fig. 2) during 2008-

29 2018. The simulation is driven by BUE1 (Fig. S2). Relative linear trends and their p values for 2012-2018 are inset.

30 1 DU = 2.69 $\times$ 10^{16} molecules cm^{-2}.

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