Supplement of

Improved gridded ammonia emission inventory in China

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Table S1 Emission factor index for fertilizer application

Factor		Value	References
EF_0	urea	17.4 % NH3-N	(Cai et al., 2002; Dong et al., 2009; Zhou et al., 2016; Zhao et al., 2020)
	ammonium bicarbonate	21.3% NH3-N	
	diammonium phosphate	7.3% NH3-N	
	NPK compound fertilizer	5% NH3-N	
	other	4% NH3-N	
Crop	Upland crops	-0.045	(Zhang et al., 2018)
	Flooded crops	0	
Method	Basal	-1.139	(Huang et al., 2012)
	Top	0	
Soil pH		$0.067\times pH^2-0.69\times pH+0.68$	(Bouwman et al., 2002; Zhang et al., 2018)
Soil CEC	CEC ≤16	0.088	(Zhang et al., 2018)
	16＜CEC≤24	0.012	
	24＜CEC≤32	0.163	
	CEC＞32	0	

Note: for soil pH, a second-order function is applied to fit the segmental values given in (Bouwman et al., 2002; Zhang et al., 2018).

Table S2 The parameters used in estimates of annual TAN excretion per cattle

	Raising cycle	Excretion (kg/cattle/day)		Nitrogen content (%)		TAN (%)
		Urine	Excrement	Urine	Excrement	
beef cattle	365	10	20	0.9	0.38	60
dairy cow	365	19	40	0.9	0.38	60
goat	365	0.75	2.6	1.35	0.75	50
sheep	365	0.75	2.6	1.35	0.75	50
rabbit	55	0.3	0.15	0.15	1.72	45
horse/donkey/mule	365	6.5	15	1.4	0.2	60
sow	365	5.7	2.1	0.4	0.34	70
fattening pig	75	3.2	1.5	0.4	0.34	70
camel	365	6.5	15	1.4	0.2	60
meat duck	55	-	0.1	-	1.1	70
meat goose	70	-	0.1	-	0.55	70
broilers	50	-	0.09	-	1.63	70
laying hen	365	-	0.12	-	1.63	70
laying duck	365	-	0.13	-	1.1	70

Table S3 the EF and spatial allocation methods of NH3 emission sources

Category	Subcategory	EF	Spatial allocation
Transportation	light-duty gasoline vehicles	0.026 g/km	Road density [a]
	heavy-duty gasoline vehicles	0.028 g/km	
	light-duty diesel vehicles	0.004 g/km	
	heavy-duty diesel vehicles	0.017 g/km	
	motorcycles	0.007 g/km	
Residential & commercial	human excrement	787 g/capita	Rural population [b]
	indoor firewood combustion	1.3 g/kg	
	indoor wheat burning	0.52 g/kg	
	indoor rice burning	0.37 g/kg	
	Indoor maize burning	0.68 g/kg	
	domestic coal combustion	1 g/kg	Population [b]
	domestic oil combustion	120 g/10^3L	
	domestic gas combustion	3203.8 g/10^4m^3	
Industry	synthetic ammonia	787 g/t	Sub-national fuel data disaggregation method using POI (SDMP) [c]
	nitrogen fertilizers production	5000 g/t	
	wastewater treatment	30 g/10^4 m^3	
	waste landfill	0.0073 kg/kg CH4	
	waste incineration	210 g/t	
	coal combustion	10 g/t	
	oil combustion	100 g/10^3L	
	gas combustion	512.6 g/10^4m^3	
Others	agricultural soil	1800 g/ha	Cropland [d]
	nitrogen-fixing plants (soybean)	1050 g/ha	Soybean harvest areas [e]
	nitrogen-fixing plants (peanuts)	1200 g/ha	Groundnut harvest areas [e]
	outdoor straw burning	0.53 g/kg	based on the gridded burned area in cropland [f]
	Forest fires	2.9 g/kg	Gridded burned areas in forest [f]
	Grassland fires	0.7 g/kg	Gridded burned areas in grass [f]

[a] The road networks were derived from the OpenStreet data (http://www.geofabrik.de).

[b] The population data in 2016 were downloaded at https://landscan.ornl.gov/download.

[c] Details about the DPOI allocation method were previously discussed (Li et al., 2019).

[d] The cropland was derived from the Resource and Environment Science and Data Center. (http://www.resdc.cn/data.aspx?DATAID=184).

[e] The harvest areas of each crop were derived from the EarthStat dataset.

[f] The gridded burned area data were determined by coupling the MCD64A1 and MCD14ML fire products based on previous studies (Li et al., 2018; Qiu et al., 2016).

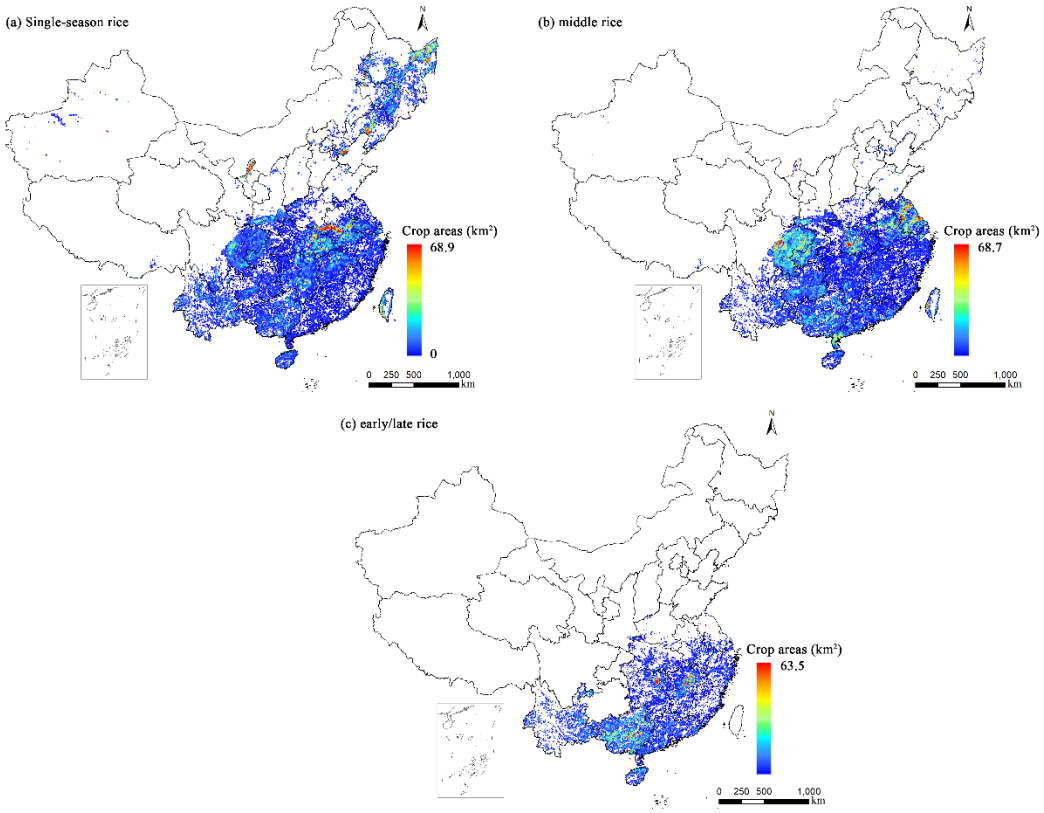

Fig. S1. The spatial distribution of single-season rice, middle rice and early/late rice.

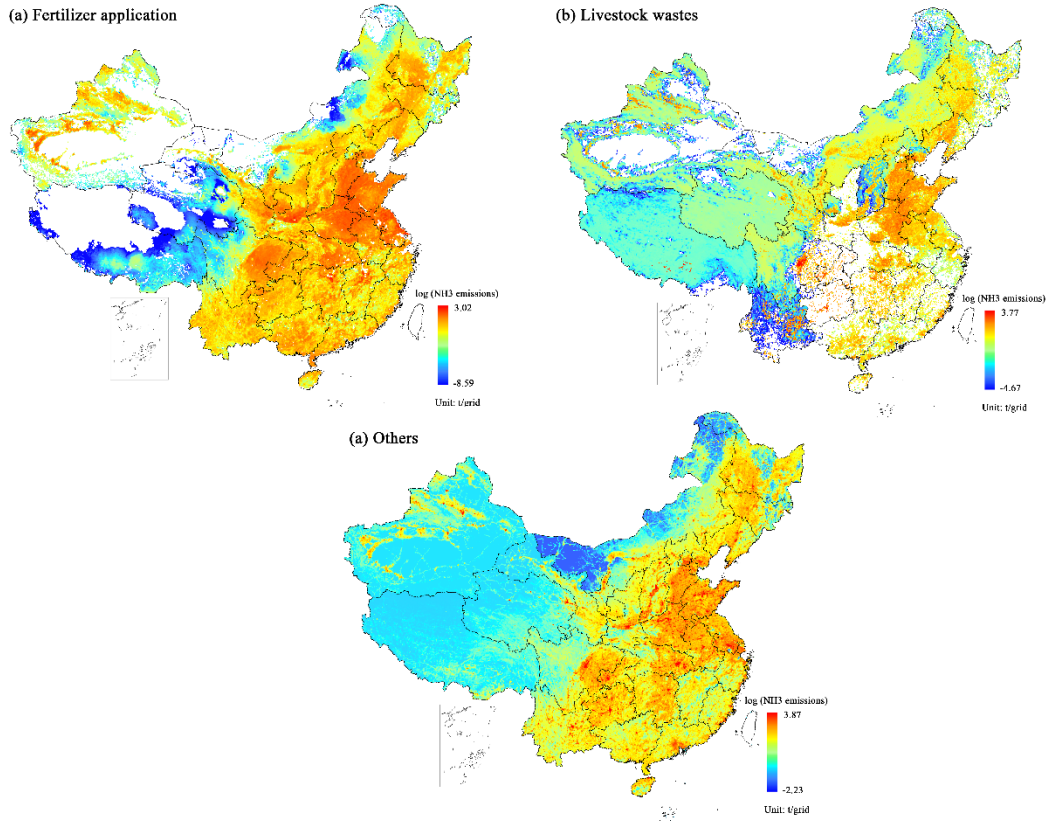

Fig. S2 Geographical distribution of NH3 emission from fertilizer application, livestock wastes, and others in mainland China (2016).

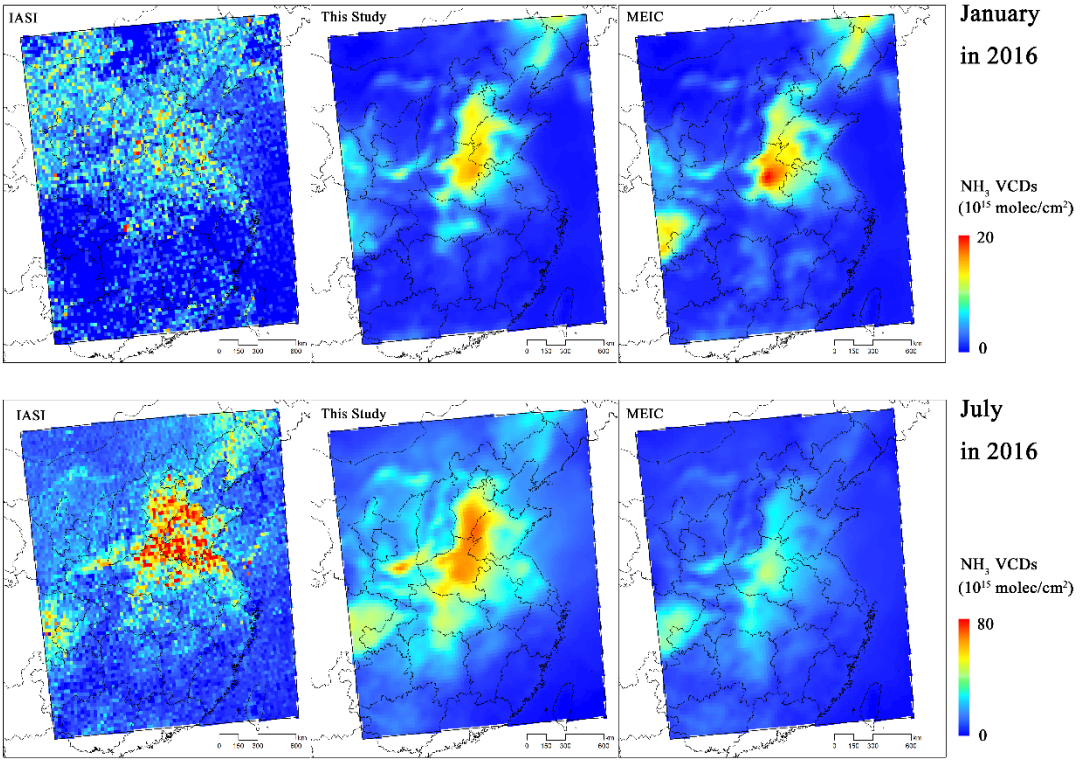

Fig. S3. The distribution of NH3 VCDs simulated with the two inventories.

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