


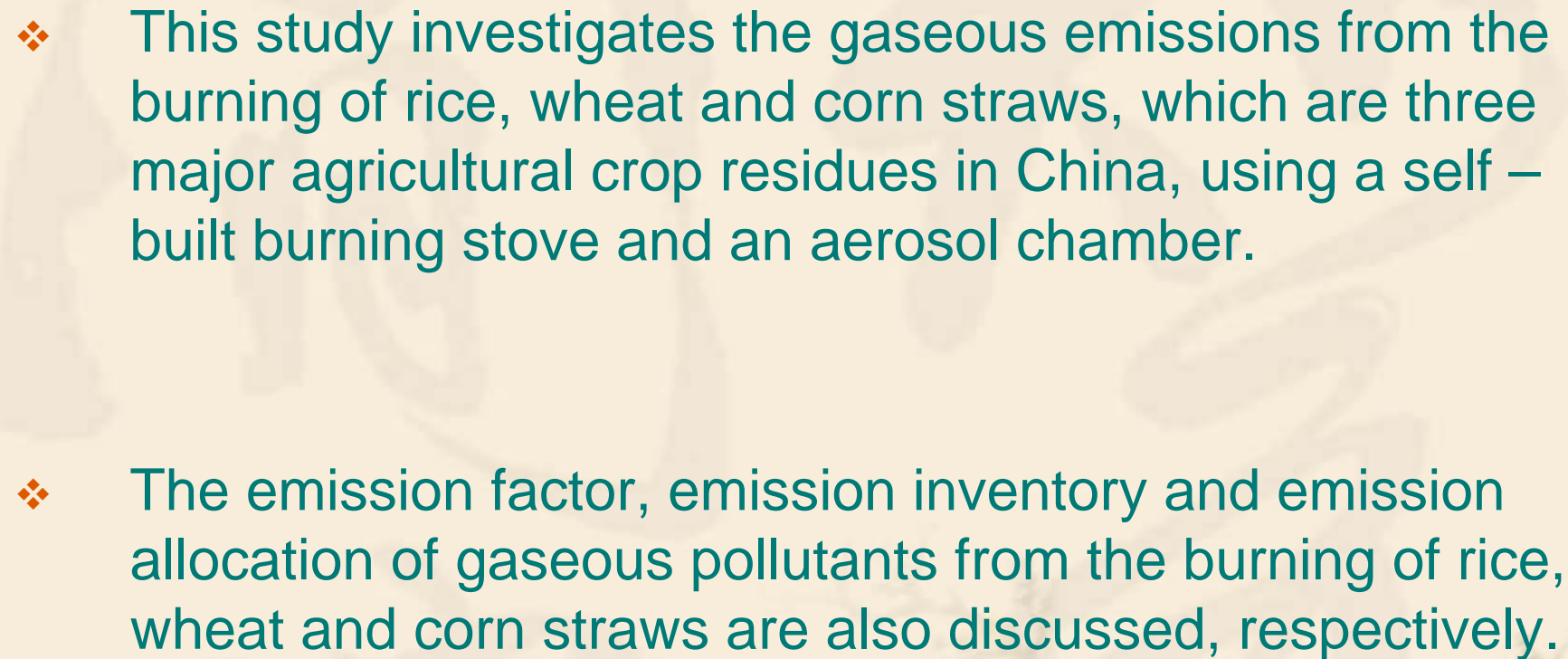


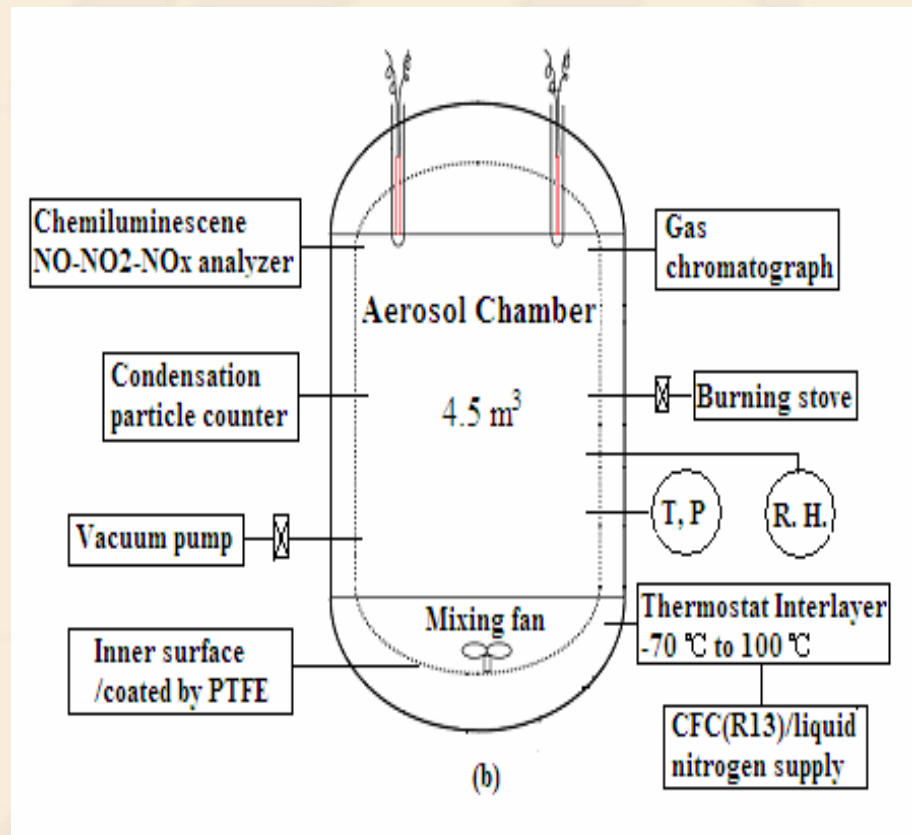
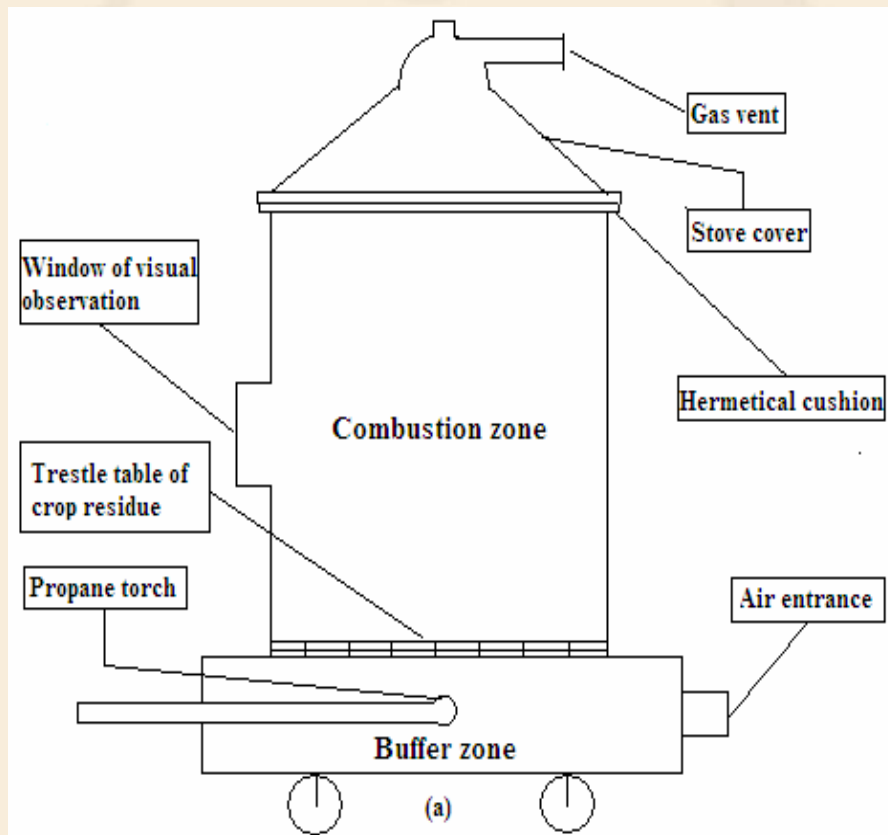
**A laboratory study of agricultural crop residue combustion
in China: Emission Factors and Emission inventory**

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- ❖ This study investigates the gaseous emissions from the burning of rice, wheat and corn straws, which are three major agricultural crop residues in China, using a self – built burning stove and an aerosol chamber.
 - ❖ The emission factor, emission inventory and emission allocation of gaseous pollutants from the burning of rice, wheat and corn straws are also discussed, respectively.



Schematic graph of the experimental system:
 (a) Burning stove, (b) Aerosol chamber and associated instruments

Chemical classification	Rice straw (n=4)	Wheat straw (n=4)	Corn straw (n=4)	Literature
CO	64.2 ± 4.9	141.2 ± 14.8	114.7 ± 12.4	52.9 ± 8.0 ^b , 92 ± 84 ^d , 99.9 ± 32.7 ^g , 60 ± 23 ⁱ , 53 ± 4.0 ⁱ .
CO ₂	791.3 ± 12.5	1557.9 ± 85.8	1261.5 ± 59.9	1515 ± 177 ^d , 1787 ± 36 ^e , 1400 ^f , 1225 ± 101 ^g , 1540-1615 ^h . 1470 ± 46 ⁱ , 1350 ± 16 ⁱ .
NO ₂	0.79 ± 0.05	0.32 ± 0.06	0.43 ± 0.03	0.56 ± 0.47 ^e
NO	1.02 ± 0.03	0.79 ± 0.13	0.85 ± 0.06	0.78 ± 0.71 ^e
NO _x	1.81 ± 0.09	1.12 ± 0.19	1.28 ± 0.04	2.63 ^c , 2.5 ± 1.0 ^d , 1.70 ± 1.68 ^e , 3 ^f , 0.89 ± 0.48 ^g . 3.3 ± 1.7 ⁱ , 4.3 ± 1.8 ⁱ ,

Emission factors of gas pollutant emitted from the burning of rice, wheat and corn straw (g kg⁻¹)

^bDhammapala et al. (2006); wheat.

^cDennis et al. (2002); Wheat.

^dAndreae and Merlet. (2001); Agricultural residue.

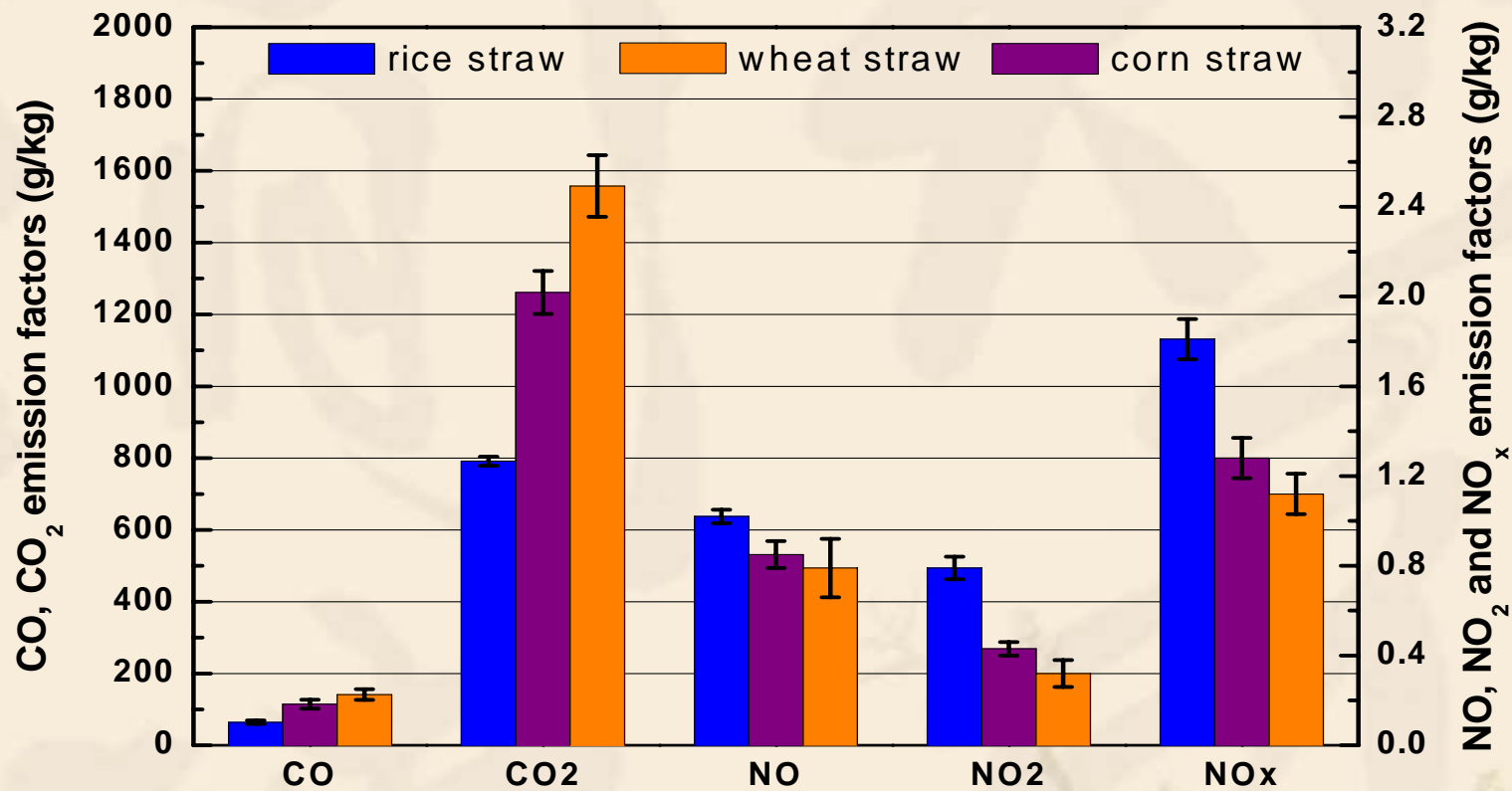
^eSahai et al. (2007); wheat straw.

^fZarate et al. (2000); Cereal waste.

^gZhang et al. (2000); wheat residue burned as fuel.

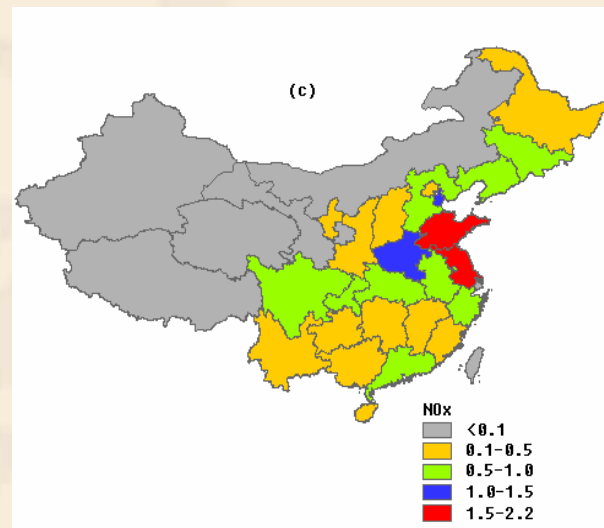
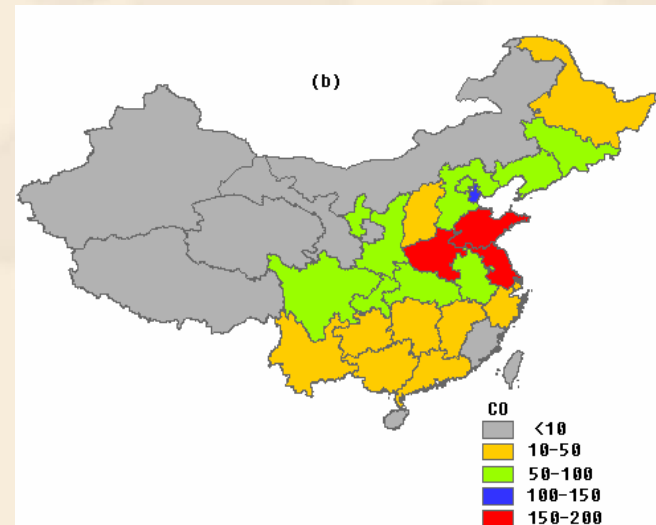
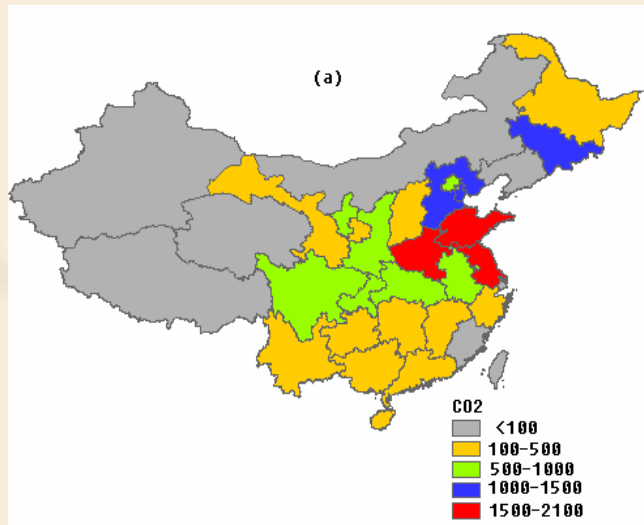
^hAir Sciences Inc (2003); wheat residue.

ⁱLi et al.(2007); wheat straw and corn stover

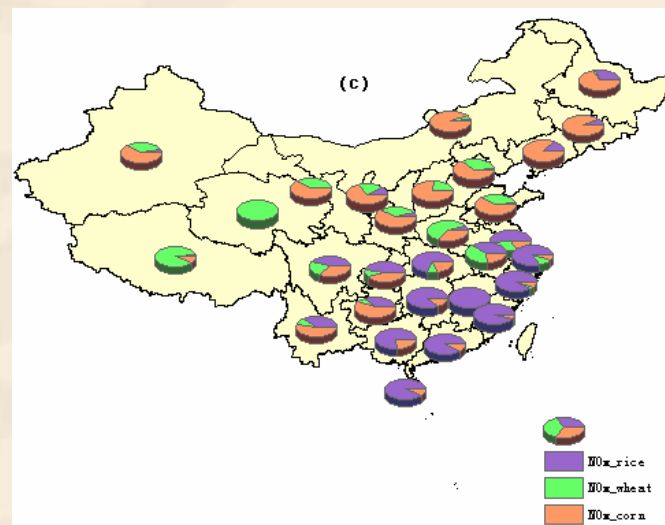
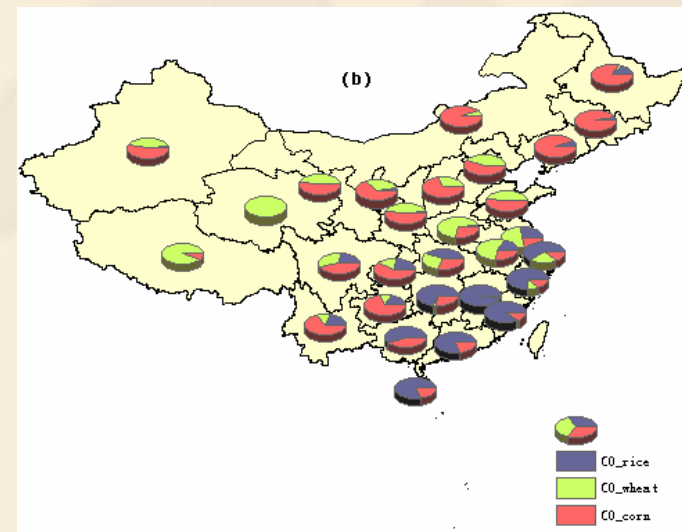
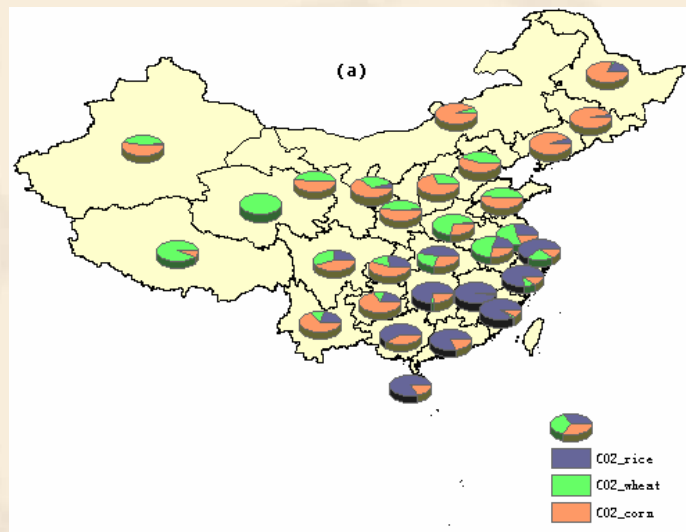


A comparison of gaseous pollutant emission factors from the burning of rice, wheat and corn straw.

Province	Agricultural crop residue (Gg)			agricultural crop residue burned in the field (Gg)			Agricultural crop residue burned as domestic fuel (Gg)		
	Rice straw	Wheat straw	Corn straw	Rice straw	Wheat straw	Corn straw	Rice straw	Wheat straw	Corn straw
Beijing	6.29	251.48	644.00	2.83	113.17	289.80	1.60	51.05	159.07
Tianjin	35.20	490.53	1296.20	14.26	198.66	524.96	8.98	99.58	320.16
Hebei	255.80	13917.22	21471.40	61.90	3367.97	5196.08	28.91	1572.65	2426.27
Shanxi	7.73	3496.69	9539.00	1.61	730.81	1993.65	0.46	206.30	562.80
Neimenggu	280.35	1078.59	17774.00	59.71	229.74	3785.86	71.49	218.95	4390.18
Liaoning	2189.22	84.69	18144.00	461.93	17.87	3828.38	757.47	29.30	6277.82
Jilin	1982.39	81.96	32306.00	414.32	17.13	6751.95	505.51	16.64	7979.58
Heilongjiang	5250.64	542.30	16618.00	1176.14	121.48	3722.43	1160.39	119.85	3672.58
Shanghai	512.11	100.95	63.00	249.40	49.16	30.68	152.61	30.08	18.77
Jiangsu	8750.91	8314.98	3945.00	2992.81	2843.72	1349.19	2966.56	2818.78	1337.36
Zhejiang	4030.19	284.67	430.00	1716.86	121.27	183.18	673.04	47.54	71.81
Anhui	6003.85	8780.65	5212.00	1122.72	1641.98	974.64	1050.67	1536.61	912.10
Fujian	3261.03	37.84	232.40	1059.84	12.30	75.53	136.96	1.59	9.76
Jiangxi	8476.16	39.48	125.40	1839.33	8.57	27.21	1000.19	4.66	14.80
Shandong	485.25	21378.31	28220.40	128.59	5665.25	7478.41	95.11	4190.15	5531.20
Henan	1496.26	31315.55	15326.20	294.76	6169.16	3019.26	335.16	7014.68	3433.07
Hubei	8356.24	2259.64	3350.00	1955.36	528.76	783.90	3877.29	1048.47	1554.40
Hunan	12897.22	225.25	2571.00	2876.08	50.23	573.33	877.01	15.32	174.83
Guangdong	7292.22	22.27	1062.60	2654.37	8.10	386.79	1531.37	4.68	223.15
Guangxi	7492.82	23.77	3194.00	1251.30	3.97	533.40	1910.67	4.82	788.92
Hainan	893.38	0.00	122.80	269.80	0.00	37.09	89.34	0.00	12.28
Chongqing	3097.18	1144.71	4140.00	600.85	222.07	803.16	789.78	232.38	1022.58
Sichuan	9170.00	5821.89	10346.00	1824.83	1158.56	2058.85	4915.12	3120.53	5545.46
Guizhou	2861.44	1019.04	6398.00	429.22	152.86	959.70	572.29	203.81	1279.60
Yunnan	3961.59	1698.62	7998.60	451.62	193.64	911.84	1010.21	344.82	1975.65
Xizang	3.49	371.96	32.40	0.30	31.62	2.75	0.89	75.51	8.00
Shananxi	470.37	5402.53	7464.00	69.61	799.57	1104.67	119.47	1372.24	1895.86
Gansu	22.30	3721.80	4888.60	3.70	617.82	811.51	4.55	759.25	997.27
Qinghai	0.00	502.69	0.00	0.00	50.77	0.00	0.00	102.05	0.00
Ningxia	230.76	1032.83	2398.60	46.38	207.60	482.12	63.69	285.06	662.01
Xinjiang	316.05	4700.41	6346.80	60.68	902.48	1218.59	80.59	954.18	1567.66
Total	100088.44	118143.29	231660.40	24091.12	26236.29	49898.92	24787.37	26481.53	54824.99



The highest CO, CO₂ and NO_x emission fluxes were from Shandong, Henan and Jiangsu provinces.



Relative proportion of gaseous pollutant emissions from burning of rice, wheat, and corn straws for the year 2004 at province-level in China: (a) CO₂ ; (b) CO ; (c) NO_x.

- ❖ **Emission factors of CO,CO₂,NO,NO₂ and NO_x were obtained.**
- ❖ **Total emission inventories for 2004 in China were 22.59, 252.92, and 0.28 Tg for CO, CO₂, and NO_x, respectively.**
- ❖ **Spatial distribution of gaseous pollutants were plotted in all provinces of China.**



The end

Thanks!

