Supplement of

Impact of a new emission inventory on CAM5 simulations of aerosols and aerosol radiative effects in eastern China

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1. Emission

Table S1. Mapping the MEIC emission to CAM5-MAM3 emission input data in China.

Species	Elevation	Sectors in CAM5 [a]	AR5 emission rates [e] (Gg/year)	Sectors in MEIC and mapping treatment [b]	MEIC emission rates [f] (Gg/year)
SO_2	Surface	dom	1692.2	res SO_2 x 97.5%	1593.3
		tra	289.0	tra SO_2 x 97.5%	101.1
		awb	29.9	-[c]	29.9
		wst	0.0	-	0.0
		shp	11.2	-	11.2
	Elevated	ene	7946.7	pow SO_2 x 97.5% [d]	4650.3
		ind	2937.5	Ind SO_2 x 97.5%	7826.3
		forest fire	7.0	-	7.0
		grass fire	1.4	-	1.4
		contvolc	0.0	-	0.0
Acc. mode sulfate	Surface	awb	0.8	-	0.8
		wst	0.0	-	0.0
		shp	0.3	-	0.3
	Elevated	ene	203.3	pow SO_2 x 2.5%	119.2
		ind	75.3	ind SO_2 x 2.5%	200.7
		forest fire	0.2	-	0.2
		grass fire	0.0	-	0.0
		contvolc	0.0	-	0.0
Ait. mode	Surface	dom	43.4	res SO_2 x 2.5%	40.9

sulfate		tra	7.4	tra SO_2 x 2.5%	2.6
	Elevated	contvolc	0.0	-	0.0
Total sulfur			**13246.0**		**14585.2**
BC	Surface	ene	20.5	pow BC	1.9
		ind	853.8	Ind BC	546.4
		dom	581.9	res BC	881.3
		tra	74.7	tra BC	286.1
		awb	43.9	-	43.9
		wst	6.4	-	6.4
		shp	0.3	-	0.3
	Elevated	fst	9.8	-	9.8
		grs	3.6	-	3.6
Total BC			**1595.0**		**1779.8**
POM	Surface	ene	93.6	pow OC x 1.4	0.0
		ind	1567.8	ind OC x 1.4	707.5
		dom	2314.5	res OC x 1.4	3778.8
		tra	129.5	tra OC x 1.4	148.3
		awb	292.8	-	292.8
		wst	9.0	-	9.0
		shp	0.5	-	0.5
	Elevated	fst	185.3	-	185.3
		grs	36.2	-	36.2
Total POM			**4629.0**		**5158.4**
SOAG	Surface	BIGALK	179.8	(pow + ind + tra + res ALK3, ALK4, ALK5)*molecular weight *mass yield*1.5[g]	376.2
		BIGENE	33.6	(pow + ind + tran + res OLE2) *molecular	91.4

		TOLUENE	352.8	weight *mass yield*1.5 (pow + ind + tra + res ARO1, ARO2) *molecular weight *mass yield*1.5	1031.9
		ISOPRENE	712.6	-	712.6
		TERPENE	1289.6	-	1289.6
Total SOAG			**2568.3**		**3501.6**
DMS	Surface		8.2	-	8.2

[a] The AR5 sector abbreviations are dom (domestic), tra (transportation), ind (industry), ene (energy), wst (waste treatment), awb (agricultural waste burning), shp (shipping), fst (forestfire), grs (grass fire)and contvolc (continuous volcano).

[b] The MEIC sector abbreviations are res (residential), tra (transportation), ind (industry), and pow(power).

[c] "-" means that the species in the sector is the same as AR5 emission.

[d] The elevated energy and industry emissions are emitted in mass fraction of 15.5% , 75.1%, and 9.4% at approximately 30, 130, and 280 meters.

[e] The masses of SO_2, sulfate and DMS are in unit of Gg of Sulfur per year in China. The unit of BC mass is Gg of Carbon per year and the units of POM and SOAG mass are Gg of POM per year, which is assumed to be 1.4 times OC (or Carbon) mass.

[f] The units are the same as in the column of AR5 emission rates.

[g] Atmoic compositions for BIGALK, BIGENE, TOLUENE are C_5H_{12}, C_4H_8, and $C_6H_5(CH_3)$, respectively. Mass yields of BIGALK, BIGENE, and TOLUENE are 5%, 5%, 15%, respectively.

2. Observed surface concentration of aerosol in China

Table S2. The observations of surface concentrations of chemical species in $PM_{2.5}$ over eastern China in 2009 and 2010.

Locations	Coordinates	Time	Chemical species	References	Location type
Harbin	45.82°N, 126.56°E	Aug-Dec, 2010	SO_4,BC,OC	Huang et al.[2014]	urban
Chengde	40.95°N, 117.96°E	April/July/Oct, 2009;Jan, 2010	SO_4,BC,OC	Zhao et al. [2013]	urban
Shangdianzi	38.04°N, 114.51°E	April/July/Oct, 2009;Jan, 2010	SO_4,BC,OC	Zhao et al. [2013]	rurual
Beijing1	39.93°N, 116.30°E	April/July/Oct, 2009;Jan, 2010	SO_4,BC,OC	Zhao et al. [2013]	urban
Beijing2	39.99°N, 116.30°E	April/July/Oct, 2009;Jan, 2010	SO_4,BC,OC	Zhang et al. [2013]	urban
Tianjin	39.08°N, 117.20°E	April/July/Oct, 2009;Jan, 2010	SO_4,BC,OC	Zhao et al. [2013]	urban
Shijiazhuang	38.04°N, 114.51°E	April/July/Oct, 2009;Jan, 2010	SO_4,BC,OC	Zhao et al. [2013]	urban
Zhengzhou	34.80°N, 113.50°E	April/July/Oct, 2009;Jan, 2010	SO_4,BC,OC	Geng et al. [2013]	urban
Shanghai	31.18°N, 121.42 °E	Jan, 2009	SO_4,BC,OC	Feng et al. [2012]	urban
	31.25°N, 121.46 °E	Oct, 2005; Jan/Apr/July,2006	SOA	Feng et al. [2009]	urban, suburban
Wuhan	30.50°N, 114.3 °E	Aug 2012- July 2013	SOA	Zhang et al. [2015]	urban, suburban
Chengdu*	30.65°N, 104.00°E	Apr/May, 2009	SO_4,BC,OC	Tao et al., [2013]	urban
Xiamen	24.58°N, 118.09°E	Jun,2009-May,2010	SO_4,BC,OC	Zhang et al. [2012]	urban
Guangzhou	23.10°N, 113.3°E	April/July/Oct, 2009;Jan, 2010	SO_4,BC,OC	Tao et al. [2014]	urban
	23.70°N, 113.6°E	Mar,2012-Mar,2013	SOA	Lai et al.[2015]	rurual

* *Tao et al.* [2013] highlights the importance of the dust and biomass burning episodes to the chemical composition of PM2.5. We use their data on non-episodic days.

3. Observed aerosol direct radiative effects in China

Table S3. Aerosol direct radiative effects (ADREs) at TOA, surface (SFC), and within the atmosphere (ATM) in different regions and periods in China.

Region	References	Period	TOA ($W\ m^{-2}$)	SFC ($W\ m^{-2}$)	ATM ($W\ m^{-2}$)
CSHNET	Li et al. (2010)	Jan.-Dec. 2005			
Ansai (36.85°N, 109.31°E)	Xin et al. (2007)		-0.46	-12.08	12.58
Beijing (39.97°N, 116.37°E)			-3.30	-30.60	27.30
Beijing Forest (39.96°N, 115.43°E)			-0.91	-7.59	6.66
Changbai Mt. (42.40°N, 128.63°E)				-6.67	6.82
Eerduosi (39.48°N, 110.18°E)				-6.02	6.02
Fengqiu (35.00°N, 114.40°E)			-0.12	-14.34	14.22
Fukang (44.28°N, 87.92°E)			2.03	-5.80	7.80
Haibei (37.45°N, 101.32°E)					3.57
Hailun (47.43°N, 126.63°E)				-6.78	7.06
Jiaozhou Bay (35.90°N, 120.18°E)			-2.81	-24.12	21.31
Lanzhou (36.07°N, 103.82°E)				-22.29	21.94
Lhasa (29.67°N, 91.33°E)				-4.28	4.83
Sanjiang (47.58°N, 133.52°E)			0.93	-6.92	7.85
Shanghai (31.12°N, 121.75°E)				-24.26	25.09
Shapotou (37.45°N, 104.95°E)				-7.45	7.42
Shenyang (41.52°N, 123.63°E)				-14.58	16.15
Taihu (31.40°N, 120.22°E)			-2.64	-15.79	13.15
Taoyuan (28.92°N, 111.45°E)			0.35		19.95
Xianghe (39.75°N, 116.96°E)			-1.28	-28.78	27.50
Yanting (31.27°N, 105.45°E)			1.26	-29.61	30.78
Xishuangbanna(21.9°N, 101.27°E)			2.40	-18.17	20.55
Others					
Xianghe (39.75°N, 116.96°E)	Li et al. (2007)	Jan.-Dec. 2004-2005		-24	
Beijing (39.98°N, 116.38°E)	Xia et al. (2007a)	Dec.-Feb.	-8.0	-20.3	

		Mar.-May	-13.9	-46.1	
		Jun.-Aug.	-13.5	-45.6	
		Sep.-Nov.	-10.7	-30.0	
		2001-2005			
Liaozhong (41.50°N, 120.70°E)	Xia et al. (2007b)	Mar.-May 2005		-30	
Taihu (31.70°N, 120.36°E)	Xia et al. (2007c)	Jan.-Dec. 2005-2006	0	-38.4	
Nanjing (32.05°N, 118.78°E)	Zhuang et al. (2014)	Jan.-Dec. 2011-2012	-6.9	-21.3	
SACOL (35.95°N, 104.10°E)	Liu et al. (2011)	May 2009	-7.78	-38.45	30.68

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