Supplement of Atmos. Chem. Phys., 14, 4573–4585, 2014
http://www.atmos-chem-phys.net/acp-14-4573-2014/
doi:10.5194/acp-14-4573-2014-supplement

Atmospheric Chemistry and Physics Open Access

Supplement of

Impact of biomass burning on haze pollution in the Yangtze River delta, China: a case study in summer 2011

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Table S1 Site information for the field campaign in the YRD region.

Site Location	2010 city population[a] (million)	Elevation (MSL, m)	Inlet height (AGL, m)	Surrounding conditions
Ningbo	7.6	7	17	Residential & commercial area, no industrial sources or fugitive dust nearby, 225m south to Liuting Street.
Hangzhou	8.7	14	13	Residential & commercial area, Construction site nearby, no industrial sources nearby, 275m west to Shixin South Road.
Shanghai	23.0	5	20	Residential & commercial area, no industrial sources or fugitive dust nearby, 115m east to Yuanshen Road.
Suzhou	10.5	6	15	Residential & commercial area, no industrial sources nearby, 300m west to Nanyuan South Road, 360m north to S Ring Road Elevated Bridge.
Nanjing	8.0	30	15	College district, no industrial sources or fugitive dust nearby, 123m west to Huju Road.

a: the data source is from the sixth nationwide population census of China in 2010 (http://www.stats.gov.cn/tjgb/rkpcgb/).

Table S2 Instruments and analytical method used for filed observation.

Type	Observations	Averaging time	Instrumentation and analytical method
Meteorological parameters	Temperature, Relative humidity, Wind speed/direction	1 hour	Met Station One (Met One Corp., OR, US) (Suzhou, Ningbo) TH-2009 (Tianhong Corp., Hubei, China) (Nanjing) WXT520 (Vaisala Corp., Finland) (Shanghai) WS 600 (LUFFT Corp., CA, US) (Hangzhou)
	Visual range	1 hour	Model 6000 (Belfort Instrument Corp., MD, US) (Suzhou, Hangzhou, Ningbo) PWD22 (Vaisala Corp., Finland) (Shanghai, Nanjing)
PM mass concentration	$PM_{2.5}$, PM_{10}	1 hour	TEOM1405[a] (Thermo Scientific Corp., MA, US) (Shanghai, Nanjing, Suzhou, Hangzhou) R&P1400a[a] (Thermo Scientific Corp., MA, US) (Ningbo)
$PM_{2.5}$ species[b]	Mass concentration	22hrs[c]	Partisol 2300 Speciation Sampler (Thermo Scientific Corp., MA, US) Filter gravimetric weighting: Mettler Toledo XP6 Microbalance Filter equilibrium condition: RH 40±5%, Temperature 20±2°C
	Water-soluble ions (NH_4^+, Na^+, K^+, Ca^{2+}, Mg^{2+}, SO_4^{2-}, NO_3^-, Cl^-)	22hrs[c]	Ion chromatography (Dionex-3000, Dionex Corp,CA,US) (Chow and Watson, 1999)
	Carbonaceous component (organic carbon, elemental carbon)	22hrs[c]	IMPROVE-TOR (DRI Model 2001A Carbon Analyzer, Atmoslytic Inc., CA, US)(Chow et al., 2007)
	Elements (Al, As, Br, Ca, Cr, Cu, Fe, Mn, Ni, Pb, Rb, Se, Si, Sr, Ti and Zn)	22hrs[c]	X-Ray Fluorescence (Epsilon 5 ED-XRF, PANalytical B.V., the Netherlands) (Cao et al., 2012)

a: The heating temperature of TEOM1405 and R&P1400 are 50°C.

b: $PM_{2.5}$ species are available for the sites of Shanghai, Suzhou and Nanjing.

c: 22hours refers to 14:00 to 12:00 of the next day.

For **Table S1**, The Ningbo and Shanghai sites were near the East China Sea where they can be influenced by marine weather systems. The Suzhou site was east of Taihu Lake, the third largest freshwater lake in China. The Hangzhou and Nanjing sites were bordered on three sides by mountains with elevations up to 400 m.

For **Table S2**, $PM_{2.5}$ sampling were conducted by Thermo Partisol®- 2300 Speciation Sampler's two parallel channels. Teflon-membrane filters were weighed before and after analysis to calculate mass concentrations, then submitted to x-ray fluorescence (XRF) analysis for Al, As, Br, Ca, Cr, Cu, Fe, Mn, Ni, Pb, Rb, Se, Si, Sr, Ti and Zn concentrations (Cao et al., 2012). A 0.5 cm^2 punch from the quartz-fiber filter was submitted to the IMPROVE_A thermal-optical reflectance protocol (Chow et al., 1993,2007,2011) to quantify organic carbon (OC) and elemental carbon (EC). The remaining quartz-fiber filter was extracted in distilled-deionized water by ultrasonic and analyzed for cations (NH_4^+,Na^+,K^+,Ca^{2+},Mg^{2+}) and anions (SO_4^{2-},NO_3^-,Cl^-,F^-) by ion chromatography (IC) (Chow and Watson, 1999). Sampling flow rate was 10 L/min for quartz-fiber filter (47mm, Whatman QMA, UK) and 16.7 L/min for Teflon-membrane filter (47mm, Whatman QMA, UK). Flow rate of sampler was calibrated and tested daily by Gilibrator II Flowmeter (Sensidyne, US) and the bias was ≦±5%. Sampling cartridge was cleaned daily with methanol moistened Kimwipes while the $PM_{2.5}$ impactor was cleaned weekly and coated with grease. Prior to sampling quartz-fiber filters were preheated to 600 °C for 5 hours to remove the absorbed VOCs (Watson et al., 2009;Chow et al., 2010). All samples were stored air-tight in a refrigerator at about 4°C after sampling before gravimetric or chemical analysis.

The carbon analyzer was calibrated routinely with known quantities of methane such as sucrose solution (Chow et al., 2011). Replicate OC/EC analyses were performed on 10% of the samples. Standard reference solutions produced by the National Research Center for Certified Reference Materials in China were interspersed every 10 samples during IC measurement and each sample was analyzed twice. Before and after sampling the Teflon filter was equilibrated using controlled temperature (18-22°C) and relative humidity (35-45%) dessicators for 24 h prior to weighing. Average field blanks were subtracted from the measured concentration of all samples for all compositions.

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