

# Supplement materials

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

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1 **Table S-1.** Site information for the field campaign in the YRD region.

| Site Location | 2010 city population <sup>a</sup> (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.   |

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3 a: the data source is from the sixth nationwide population census of China in 2010

4 (<http://www.stats.gov.cn/tjgb/rkpcgb/>).

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**Table S-2.** 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)<br>TH-2009 (Tianhong Corp., Hubei, China) (Nanjing)<br>WXT520 (Vaisala Corp., Finland) (Shanghai)<br>WS 600 (LUFFT Corp., CA, US) (Hangzhou) |
|  | Visual range   | 1 hour             | Model 6000 (Belfort Instrument Corp., MD, US) (Suzhou, Hangzhou, Ningbo)<br>PWD22 (Vaisala Corp., Finland) (Shanghai, Nanjing)  |
| PM mass concentration                  | PM <sub>2.5</sub> , PM <sub>10</sub>   | 1 hour             | TEOM1405 <sup>a</sup> (Thermo Scientific Corp., MA, US) (Shanghai, Nanjing, Suzhou, Hangzhou)<br>R&P1400a <sup>a</sup> (Thermo Scientific Corp., MA, US) (Ningbo)                                     |
| PM <sub>2.5</sub> species <sup>b</sup> | Mass concentration   | 22hrs <sup>c</sup> | Partisol 2300 Speciation Sampler (Thermo Scientific Corp., MA, US)<br>Filter gravimetric weighting: Mettler Toledo XP6 Microbalance<br>Filter equilibrium condition: RH 40±5%, Temperature 20±2°C     |
|  | Water-soluble ions (NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>2+</sup> , Mg <sup>2+</sup> , SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> ) | 22hrs <sup>c</sup> | Ion chromatography (Dionex-3000, Dionex Corp,CA,US) (Chow and Watson, 1999)   |
|  | Carbonaceous component (organic carbon, elemental carbon)  | 22hrs <sup>c</sup> | 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 <sup>c</sup> | X-Ray Fluorescence (Epsilon 5 ED-XRF, PANalytical B.V., the Netherlands) (Cao et al., 2012)   |

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

3 b: PM<sub>2.5</sub> species are available for the sites of Shanghai, Suzhou and Nanjing.

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

1 For **Table S-1**, The Ningbo and Shanghai sites were near the East China Sea  
2 where they can be influenced by marine weather systems. The Suzhou site was east of  
3 Taihu Lake, the third largest freshwater lake in China. The Hangzhou and Nanjing  
4 sites were bordered on three sides by mountains with elevations up to 400 m.

5 For **Table S-2**, PM<sub>2.5</sub> sampling were conducted by Thermo Partisol<sup>®</sup>- 2300  
6 Speciation Sampler's two parallel channels. Teflon-membrane filters were weighed  
7 before and after analysis to calculate mass concentrations, then submitted to x-ray  
8 fluorescence (XRF) analysis for Al, As, Br, Ca, Cr, Cu, Fe, Mn, Ni, Pb, Rb, Se, Si, Sr,  
9 Ti and Zn concentrations (Cao et al., 2012). A 0.5 cm<sup>2</sup> punch from the quartz-fiber  
10 filter was submitted to the IMPROVE\_A thermal-optical reflectance protocol (Chow  
11 et al., 1993,2007,2011) to quantify organic carbon (OC) and elemental carbon (EC).  
12 The remaining quartz-fiber filter was extracted in distilled-deionized water by  
13 ultrasonic and analyzed for cations (NH<sub>4</sub><sup>+</sup>,Na<sup>+</sup>,K<sup>+</sup>,Ca<sup>2+</sup>,Mg<sup>2+</sup>) and anions  
14 (SO<sub>4</sub><sup>2-</sup>,NO<sub>3</sub><sup>-</sup>,Cl<sup>-</sup>,F<sup>-</sup>) by ion chromatography (IC) (Chow and Watson, 1999). Sampling  
15 flow rate was 10 L/min for quartz-fiber filter (47mm, Whatman QMA, UK) and 16.7  
16 L/min for Teflon-membrane filter (47mm, Whatman QMA, UK). Flow rate of  
17 sampler was calibrated and tested daily by Gilibrator II Flowmeter (Sensidyne, US)  
18 and the bias was  $\cong \pm 5\%$ . Sampling cartridge was cleaned daily with methanol  
19 moistened Kimwipes while the PM<sub>2.5</sub> impactor was cleaned weekly and coated with  
20 grease. Prior to sampling quartz-fiber filters were preheated to 600 °C for 5 hours to  
21 remove the absorbed VOCs (Watson et al., 2009;Chow et al., 2010). All samples were  
22 stored air-tight in a refrigerator at about 4°C after sampling before gravimetric or  
23 chemical analysis.

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

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## 1 **References**

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