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Investigating the impact of regional transport on $PM_{2.5}$ formation using vertical observation during APEC 2014 Summit in Beijing

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SUPPORTING INFORMATION

S1 Emission control measures during APEC

In Beijing, production of three largest thermal power plants and 141 industrial plants were restricted or stopped. Meanwhile, the number of private cars on road was reduced through odd/even license-plate rules and 70% of buses were off the road. Building constructions, municipal constructions and open burning were forbidden. Road sweeping and cleaning was conducted much more frequently to remove the road dust. The governmental staff had six days off from November 7th to November 12th to reduce the emissions from commuting. Moreover, neighboring provinces including Hebei, Tianjin, Shanxi, Inner Mongolia and Shandong implemented emission control plan. Furthermore, steady weather condition was forecast on November 4th and November 5th. Therefore, eighteen cities including Beijing, Tianjin, Langfang, Baoding and Shijiazhuang carried out emergency plans of emission control, to combat poor dispersion due to stable weather condition forecasted on November 4th and November 5th.)

S2 ACSM data analysis

Although default collection efficiency (CE) of 0.5 is widely used, it varies based on aerosol composition, RH and aerosol acidity (Middlebrook et al., 2012). Considering aerosol was dried before ACSM sampling, the influence of RH can be ignored. What's more, NR-PM_1 chemical components measured in this study showed no acidity (cation/anion = 1.2). As a result, aerosol composition impact was considered in this study. CE= max (0.45, 0.0833 + 0.9167 ×ANMF) was used (Middlebrook et al., 2012). ANMF is characterized by the ammonium nitrated mass fraction (ANMF). CE was calculated to be 0.45. This value was also used in the previous study in Beijing (Sun et al., 2013).

S3 baseline definition for transport component calculation

In the morning on 1st November (episode 1), air mass from the north above 1000 m arrived Beijing. The vertical temperature gradient decreased and vertical mixing became weak (wind vertical speed was very low). Consequently, $PM_{2.5}$ accumulated and had a sharp increase. Then clean and cold wind from north caused sharp increase of wind speed and decrease of atmosphere pressure. Based on the analysis above, pollution ended up at 18:00 when the week temperature ended and $PM_{2.5}$ decreased sharply (Fig. 6).

S4 Weather Research & Forecasting Model (WRF) modeling analysis

WRF version 3.7 is utilized to generate the regional meteorological fields. The parameters have been introduced in our previous studies (Wang et al., 2015).

Table S1. Instruments information at Liulihe site.

Measurement index	Instruments	Time resolution
$PM_{2.5}$/PM_{10}	TEOM1405/1400a (Thermo Scientific, USA)	1hour
SO_2	API100E (Teledyne, USA)	1hour
NO_2	API200E (Teledyne, USA)	1hour
O_3	API400E (Teledyne, USA)	1hour
Off-line $PM_{2.5}$	Partisol 2300 (Thermo Scientific, USA)	23.5 hour
NR-PM_1 chemical composition (SO_4^{2-}, NO_3^-, NH_4^+, Cl^-, Organic Matter)	ACSM (Aerodyne Research Inc. USA)	8min
Particle size distribution	Nano SMPS&SMPS&APS 3321 (TSI Inc, USA)	5min
Absorption coefficient/black carbon	Aethalometer AE42 (Margee Scientific, USA)	1 min
Meteorological data (RH, wind speed/direction, temperature, atmospheric press)	WXT520 (VAISALA, Finland)	1hour
Wind profile	CFL-03 (23rd Institute of China Aerospace Science and Industry Corporation)	6min
Temperature and humidity profile	QFW-6000 (22nd Institute of China Electronic Technology Group Corporation)	2min

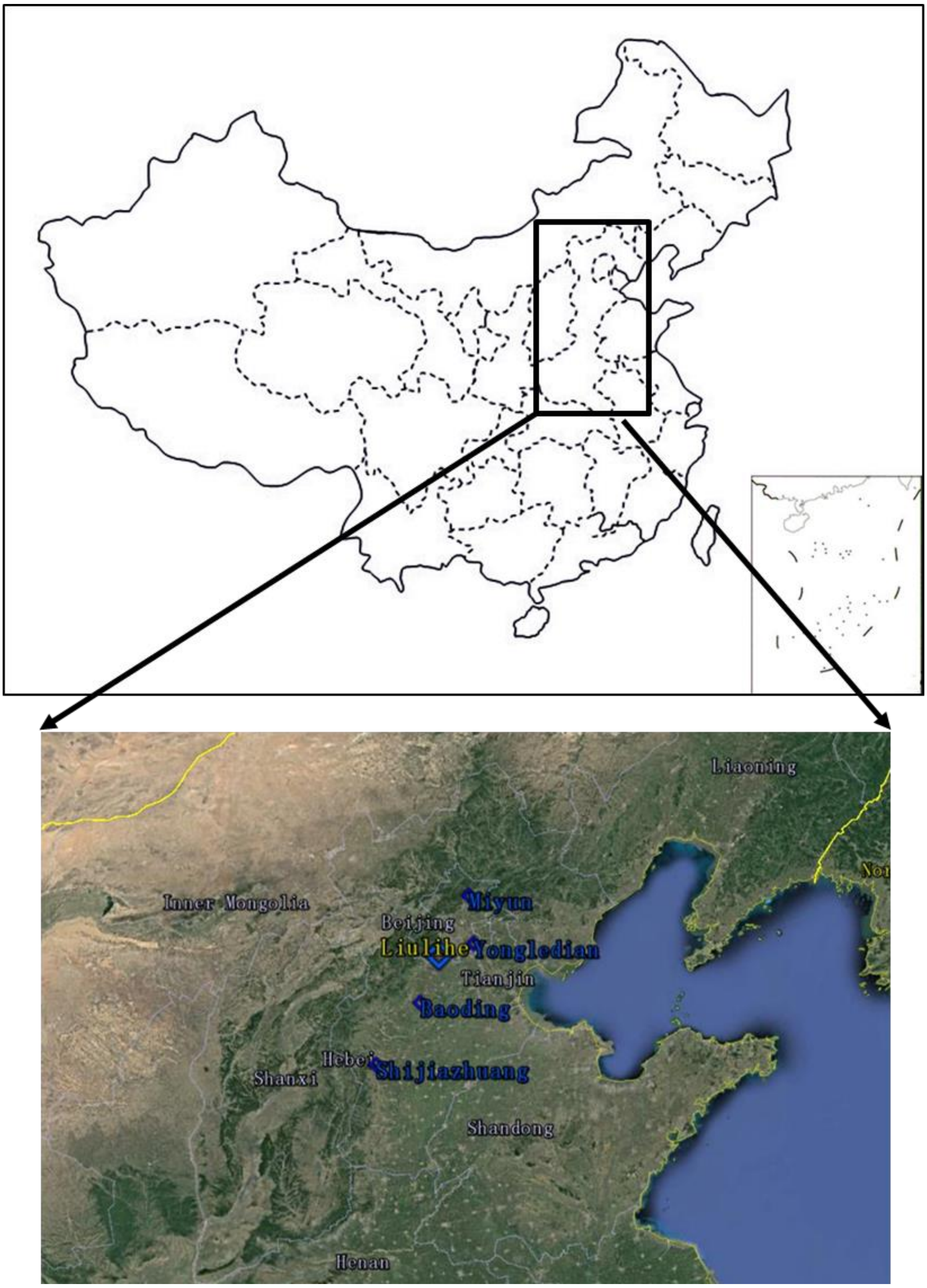


Figure S1. Field observation site location

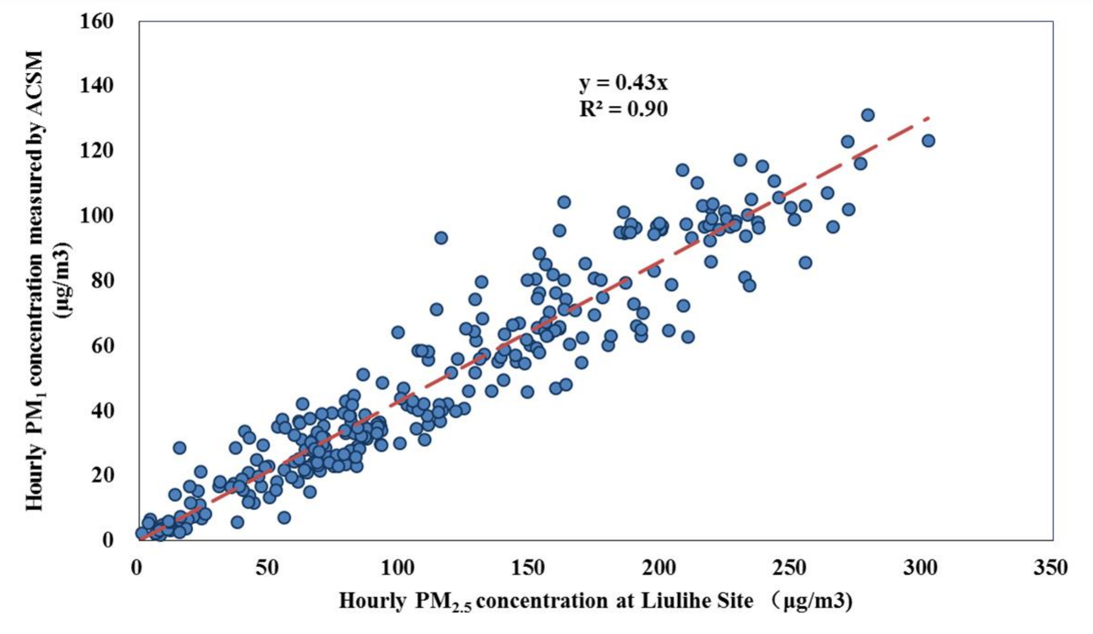


Figure S2. Correlation between NR-PM$_1$ (= Organic matter + SO_4^{2-} + NO_3^- + NH_4^+ + Cl^-) measured by the ACSM and PM$_{2.5}$ by the TEOM

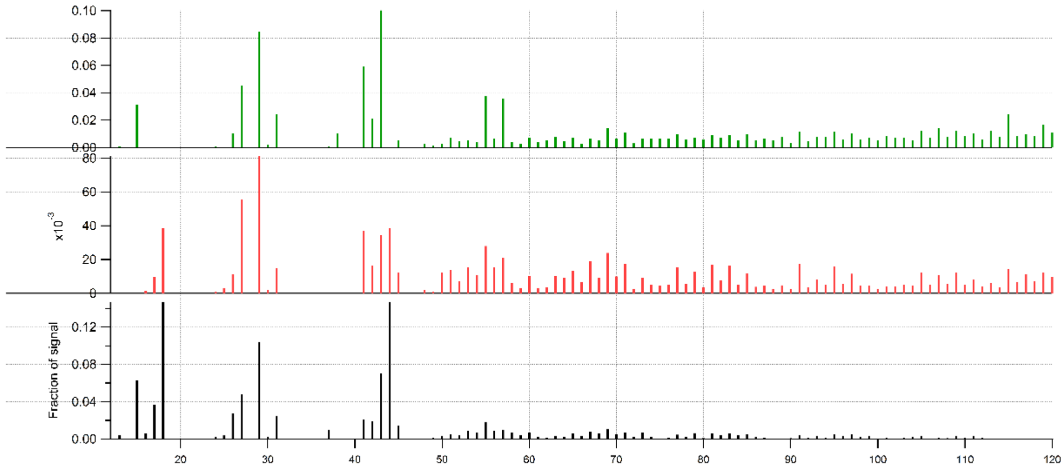
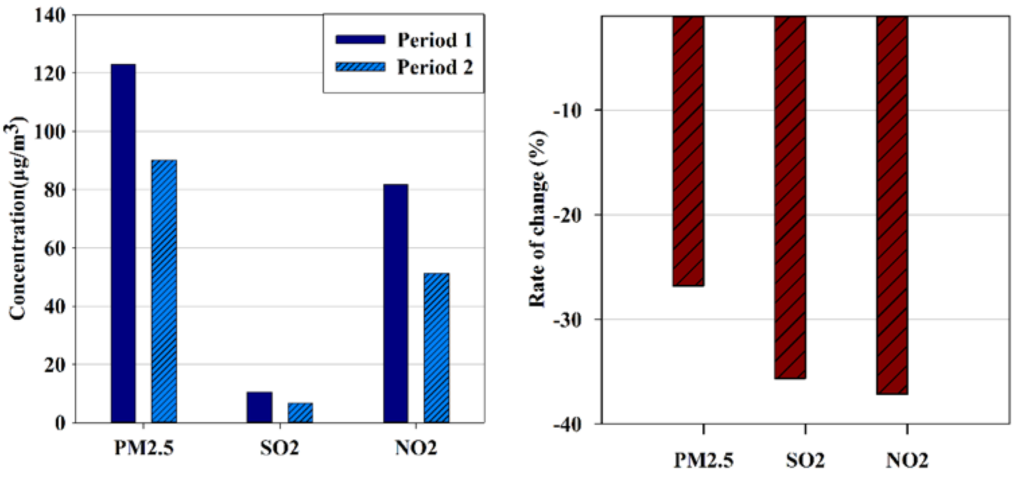


Figure S3. Factor profile performed by PMF



(a) (b)

Figure S4. Average concentration and change rate of pollutants during the observation. (a) Average concentration of pollutants; (b) Change rate of pollutants

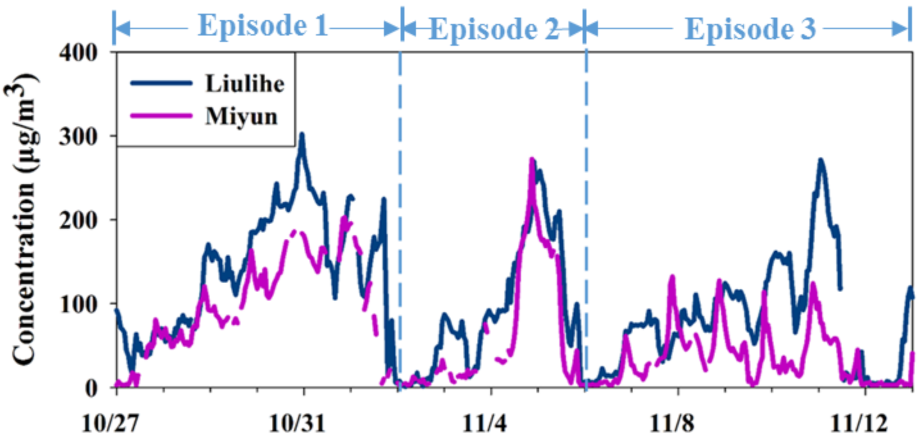


Figure S5. Hourly $PM_{2.5}$ concentrations at Liulihe and Miyun during the observation

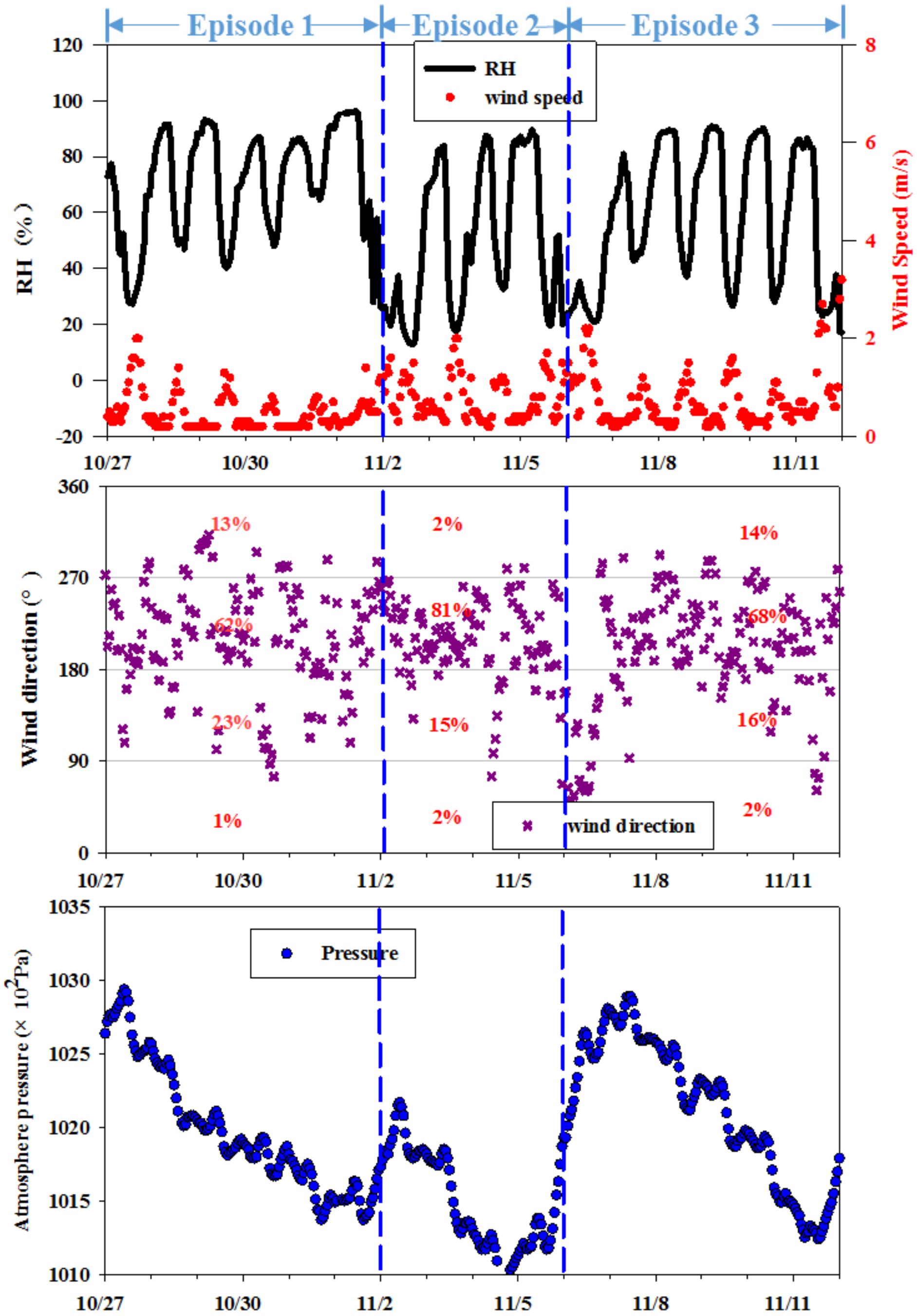


Figure S6. Meteorology conditions on the ground during the observation at Liulihe site

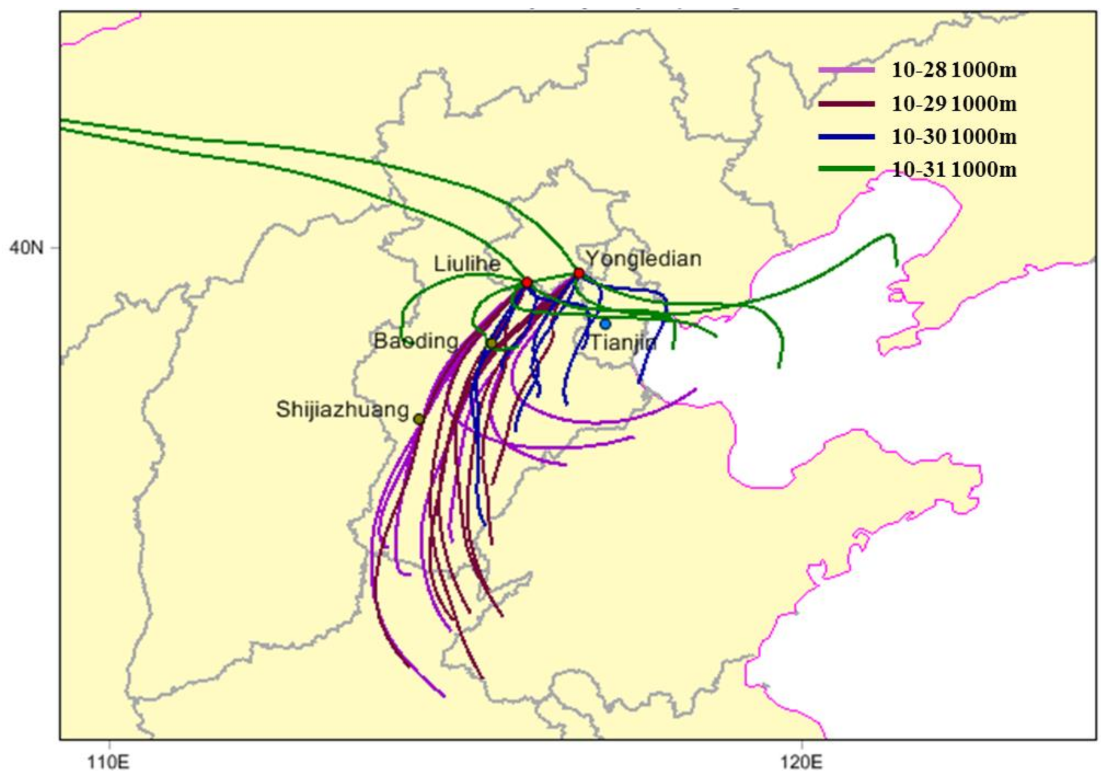


Figure S7. Air mass trajectory analysis during episode 1

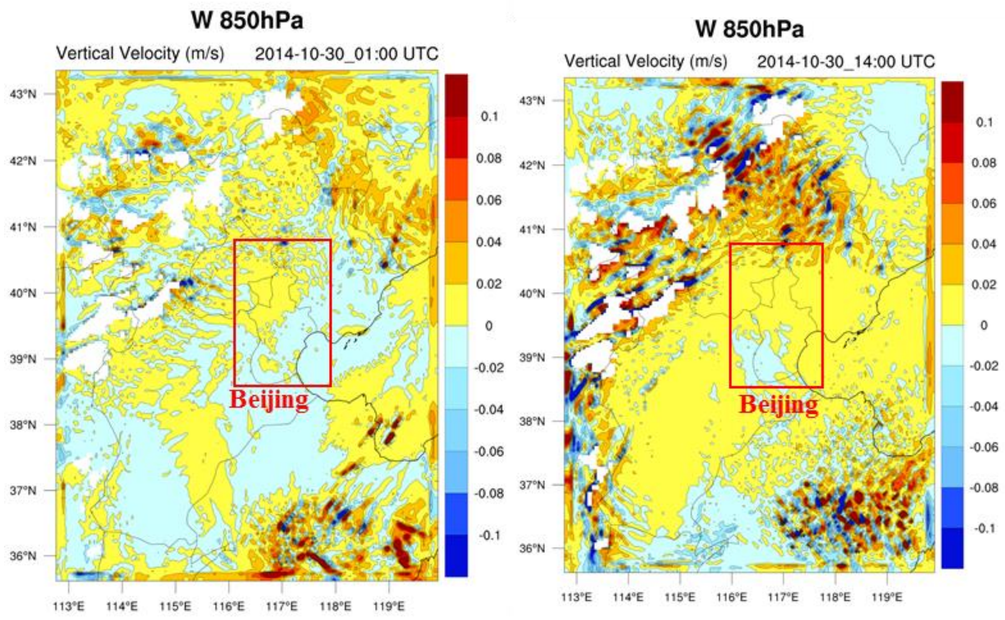


Figure S8. Regional wind vertical speed generated by WRF

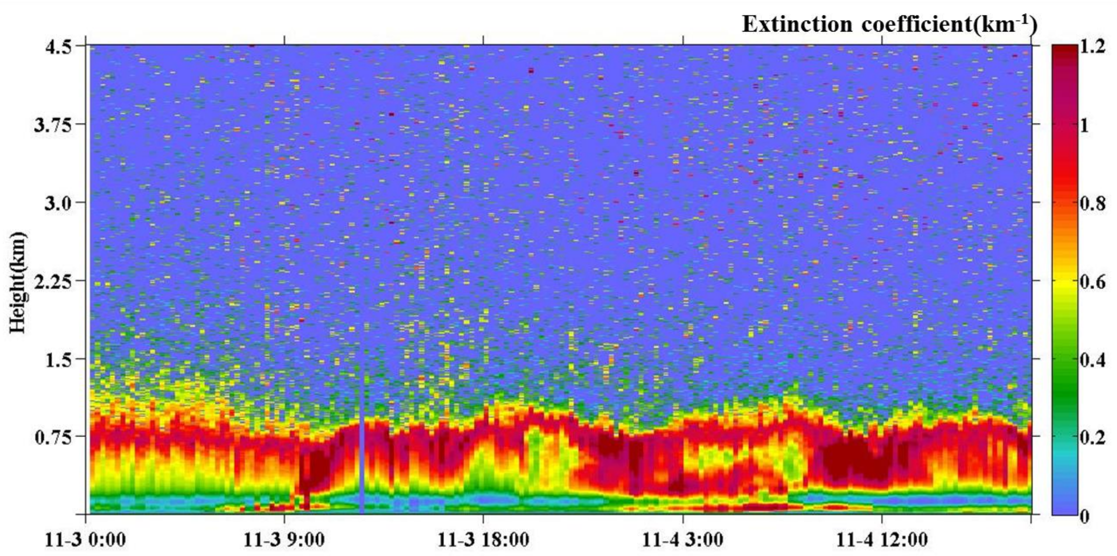


Figure S9. Vertical profile of extinction coefficient at Baoding site during episode 2 (km^{-1})

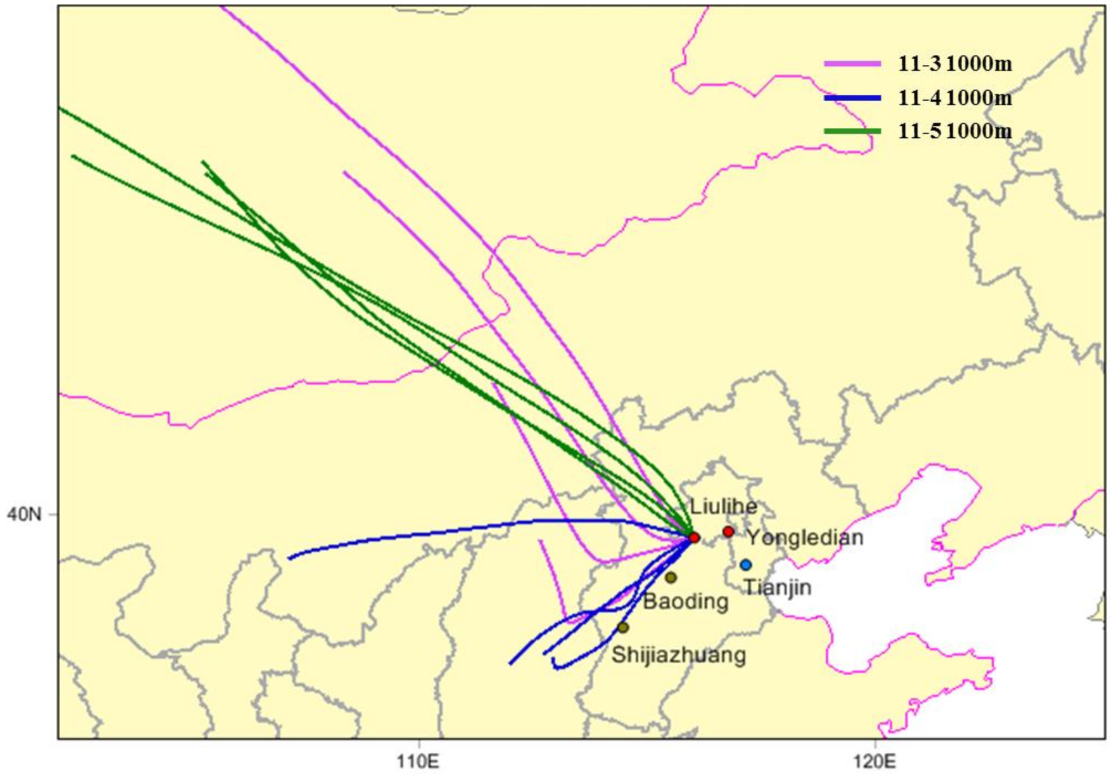


Figure S10. Air mass trajectory analysis during episode 2

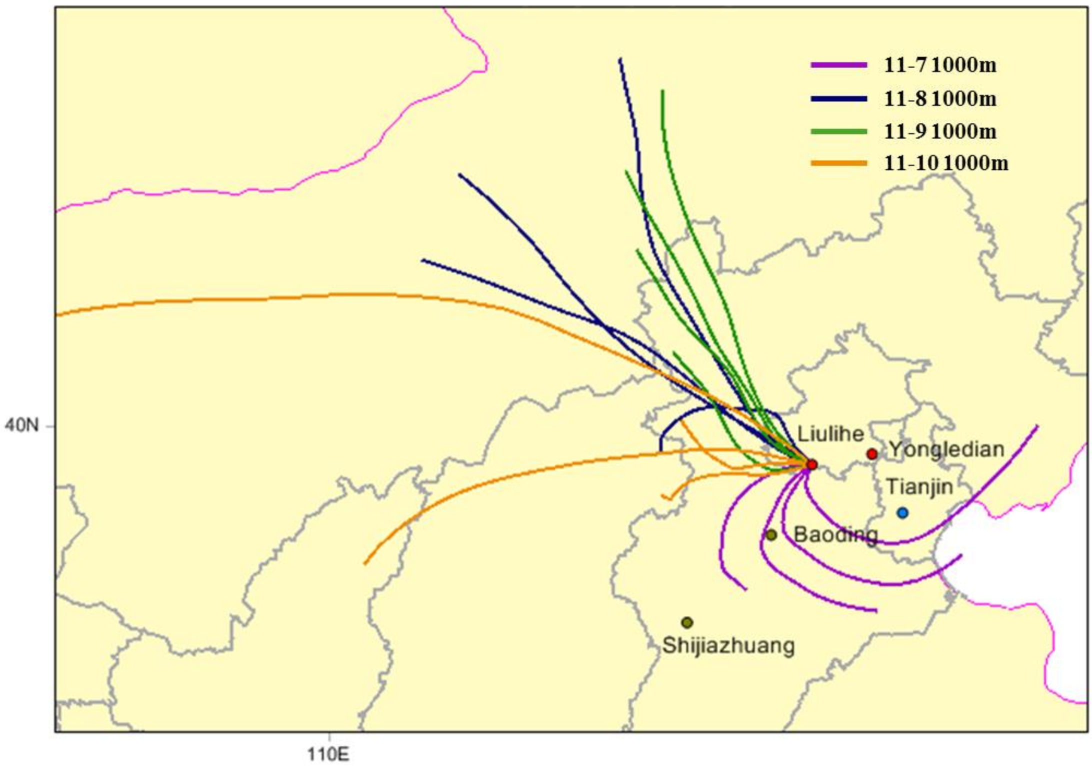


Figure S11. Air mass trajectory analysis during episode 3

References

Middlebrook, A.M., Bahreini, R., Jimenez, J.L. and Canagaratna, M.R. (2012) Evaluation of composition-dependent collection efficiencies for the aerodyne aerosol mass spectrometer using field data. Aerosol Science and Technology 46(3), 258-271.

Sun, Y.L., Wang, Z.F., Fu, P.Q., Yang, T., Jiang, Q., Dong, H.B., Li, J. and Jia, J.J. (2013) Aerosol composition, sources and processes during wintertime in Beijing, China. Atmospheric Chemistry and Physics 13(9), 4577-4592.

Wang, J., Wang, S., Voorhees, A.S., Zhao, B., Jang, C., Jiang, J., Fu, J.S., Ding, D., Zhu, Y. and Hao, J. (2015) Assessment of short-term PM 2.5-related mortality due to different emission sources in the Yangtze River Delta, China. Atmospheric Environment 123, 440-448.