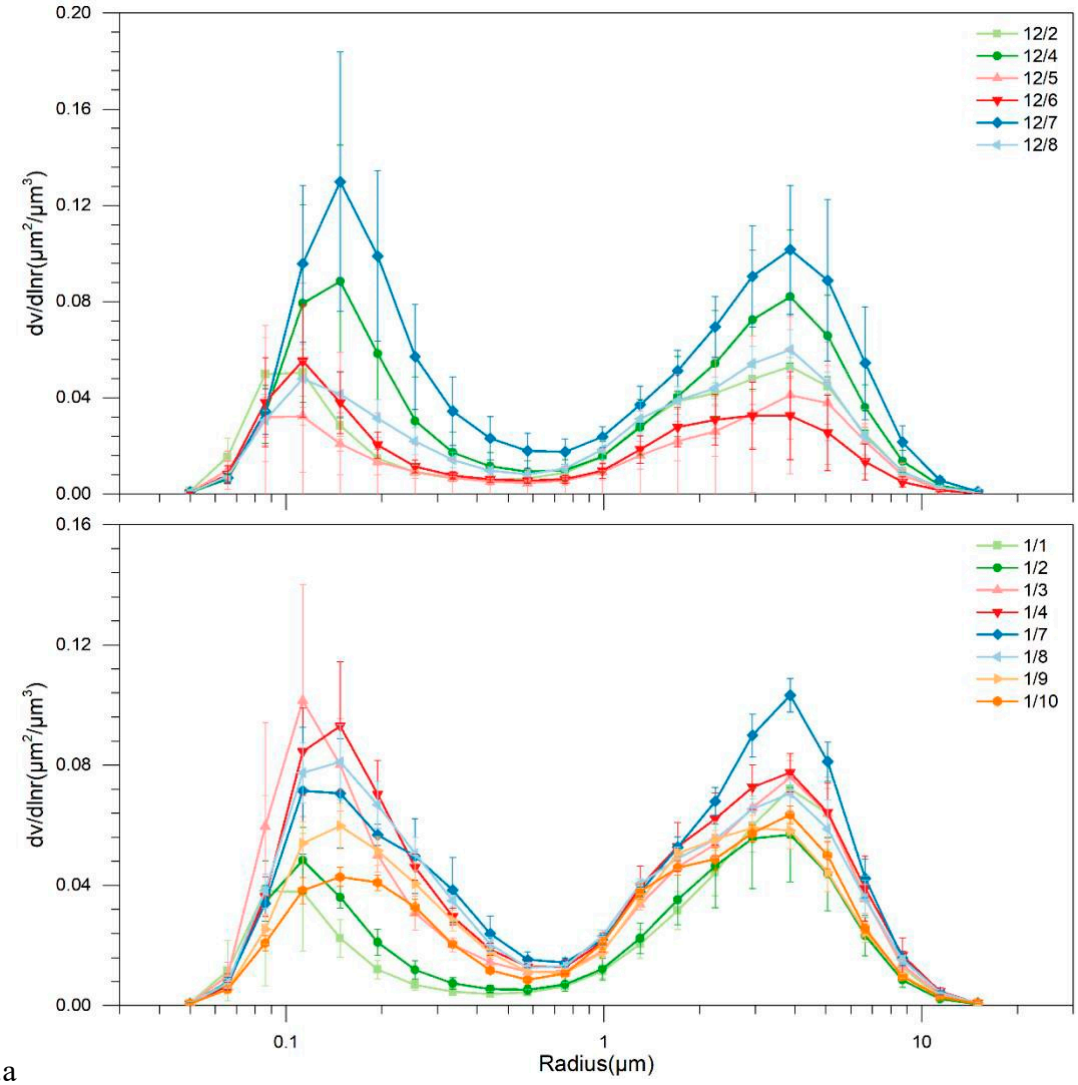

.a

Fig. S1. Volume size distribution from 0.05 to 15 μm (dV/dln(r) (μm3/μm2)) during 2–10 December 2014 and 1-10 January 2015 (China Standard Time(CST)).

Comparative statistics using indicators :Pearson's correlation coefficient (r), the Mean Error (ME), Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) are widely used parameters in previous studies to evaluate the instrumental performances [1] and also reliability of WRF Chem model simulation results [2,3], Among them, the "r" is the

correlation between the simulations and observations, the Mean Error (ME) is a measure of overall bias for continuous variables, and the Root Mean Square Error (RMSE) is the square root of the average squared error of the simulations. The specific calculation formula for each statistic is as follows:

$$\mathbf{r} = \frac{\sum_{i=1}^{n}(p_i - \overline{p})(o_i - \overline{o})}{\sqrt{\sum_{i=1}^{n}(p_i - p)^2}\sqrt{\sum_{i=1}^{n}(o_i - \overline{o})^2}} \quad \text{(S1)}$$

$$\mathbf{ME} = \frac{1}{\mathbf{n}}\sum_{i=1}^{n}(p_i - o_i) \quad \text{(S2)}$$

$$\mathbf{MAE} = \frac{1}{n}\sum_{i=1}^{n}|p_i - o_i| \quad \text{(S3)}$$

$$\mathbf{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(p_i - o)^2} \quad \text{(S4)}$$

Where p_i is the simulation, o_i is the observation, and n is the total number of hours for which the simulations are compared with observations.

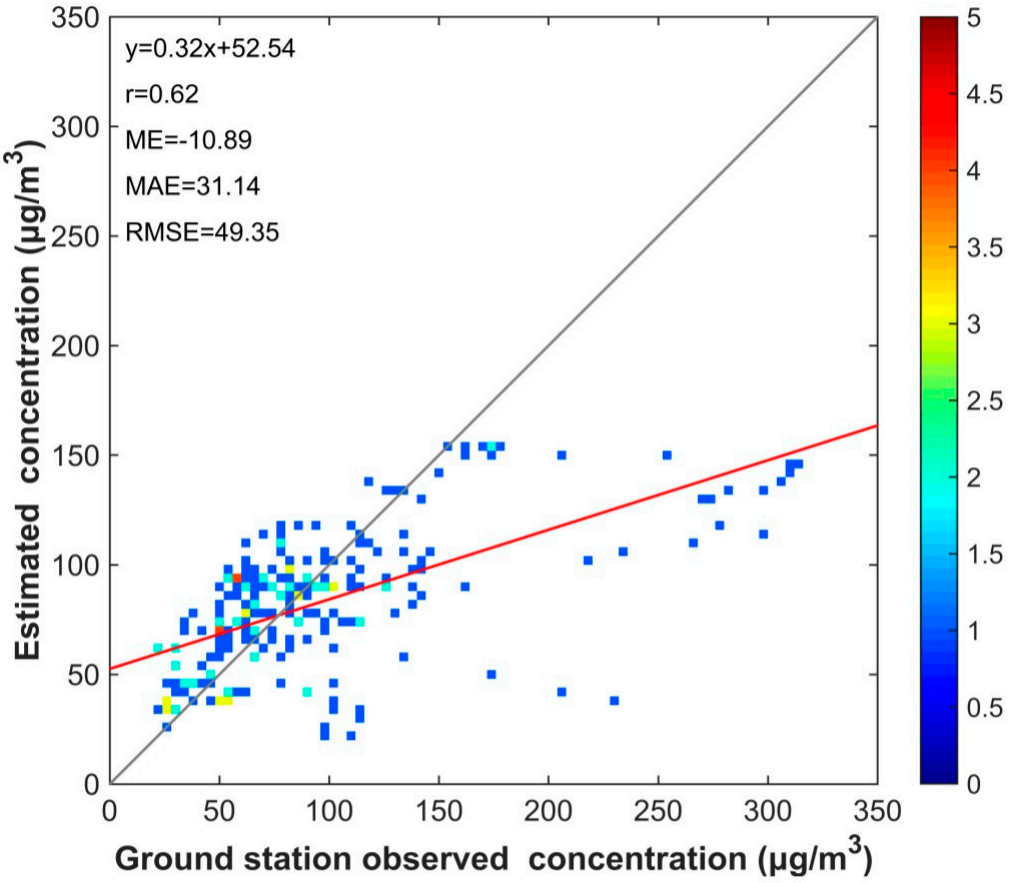

Fig. S2. Comparison between model simulation and China Environmental Monitoring Station observation value of PM2.5 concentration.

Figure S2 shows the comparison between model simulations and observations of PM2.5 concentration. The correlation coefficient is 0.62, which indicates that the model well simulates the PM2.5 data during the haze pollution period.

References:

1. Lolli, S.; Delaval, A.; Loth, C.; Garnier, A.; Flamant, P.H. 0.355-Micrometer Direct Detection Wind Lidar under Testing during a Field Campaign in Consideration of ESA's ADM-Aeolus Mission. *Atmos. Meas. Tech.* **2013**, *6*, 3349–3358, doi:10.5194/amt-6-3349-2013.
2. Chen, D.; Xie, X.; Zhou, Y.; Lang, J.; Xu, T.; Yang, N.; Zhao, Y.; Liu, X. Performance Evaluation of the {WRF}-Chem Model with Different Physical Parameterization Schemes during an Extremely High {PM}2.5 Pollution Episode in Beijing. *Aerosol Air Qual. Res.* **2017**, *17*, 262–277, doi:10.4209/aaqr.2015.10.0610.
3. Cheng, W.Y.Y.; Steenburgh, W.J. Evaluation of Surface Sensible Weather Forecasts by the WRF and the Eta Models over the Western United States. *Weather Forecast.* **2005**, *20*, 812–821, doi:10.1175/WAF885.1.