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Supplement of

Severe winter haze days in the Beijing–Tianjin–Hebei region from 1985 to 2017 and the roles of anthropogenic emissions and meteorology

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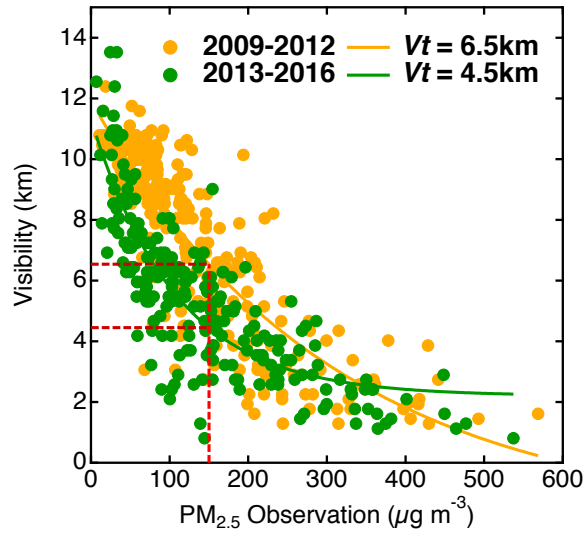


Figure S1. Approach for obtaining the visibility threshold (V_t , km) at the Beijing site for defining SWHD based on atmospheric visibility.

- 1) Select the period with observations of both $PM_{2.5}$ (from U.S. embassy) and atmospheric visibility (from NCDC database) available at the Beijing site: 2009-2016; 2) scatterplot the daily atmospheric visibility vs. daily mean $PM_{2.5}$ for all samples over the manual period of 2009-2012 (yellow) and the automatic period of 2013-2016 (green); 3) for each period, perform an exponential fit as $Vis = C_1 + C_2 \exp(C_3 * PM_{2.5_obs})$, where C_1 , C_2 and C_3 are all parameters, and obtain the V_t that corresponds to the observed $PM_{2.5}$ concentration of $150 \mu\text{g m}^{-3}$. Also presented here are the V_t values. The V_t values obtained from the 2009-2012 period were used to obtain the SWHDs for the entire manually observed period of 1985-2012, and the V_t values obtained from the 2013-2016 period were used for the automatically observed period of 2013-2017.

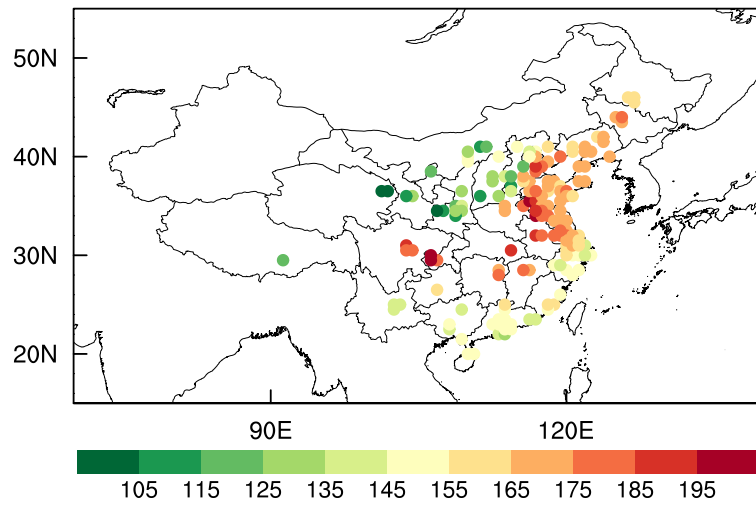


Figure S2. Obtained threshold concentrations (C_t , $\mu\text{g m}^{-3}$) for simulated $\text{PM}_{2.5}$ at 161 grids in China. Red/green circles indicate grids with high/low biases in simulated $\text{PM}_{2.5}$. The C_t values are used to obtain the SWHDs at each of the grids from 1985-2017.

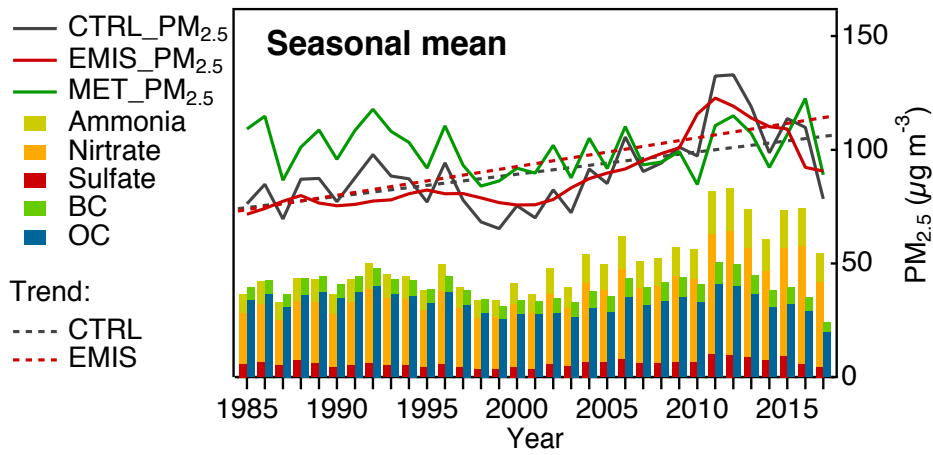


Figure S3. Time series of simulated seasonal mean concentrations of PM_{2.5} (µg m⁻³, CTRL: black line, EMIS: red line, MET: green line) and its components (µg m⁻³, CTRL: bars) in BTH from 1985-2017. Also shown are the linear trends (dashed lines) calculated for the results of the CTRL and EMIS simulations, which are statistically significant above the 95 % confidence level. The MET simulation results do not pass the significance test.

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