Supplement of

Air Quality and Climate Change, Topic 3 of the Model Inter-Comparison Study for Asia Phase III (MICS-Asia III), Part I: overview and model evaluation

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Equations of model evaluation metrics:

The following equations show how they are calculated, where M_i is the individual model result at time i (total time is n), and O_i is the individual observation data at time i. $\overline{M}$ and $\overline{O}$ are the mean values of model and observation over time from 1 to n.

$$r = \frac{\sum_{i=1}^{n}(M_i-\overline{M})(O_i-\overline{O})}{\sqrt{\sum_{i=1}^{n}(M_i-\overline{M})^2}\sqrt{\sum_{i=1}^{n}(O_i-\overline{O})^2}} \quad (1)$$

$$\mathrm{R}MSE = \sqrt{\frac{\sum_{i=1}^{n}(M_i-O_i)^2}{n}} \quad (2)$$

$$MBE = \frac{\sum_{i=1}^{n}(M_i-O_i)}{\mathrm{n}} \quad (3)$$

$$NMB = \frac{\sum_{i=1}^{n}(M_i-O_i)}{\sum_{i=1}^{n}(O_i)} \times 100\% \quad (4)$$

$$MFB = \frac{1}{\mathrm{n}}\sum_{i=1}^{n}\frac{(M_i-O_i)}{(\frac{M_i+O_i}{2})} \quad (5)$$

$$MFE = \frac{1}{\mathrm{n}}\sum_{i=1}^{n}\frac{|M_i - O_i|}{(\frac{M_i + O_i}{2})} \quad (6)$$

Table S1. Physics configurations of WRF-Chem and NU-WRF applications

	M1	M2	M3&M4
Microphysics	Lin scheme	Morrison double-moment	Goddard
Longwave radiation	RRTMG	RRTMG	Goddard
Shortwave radiation	RRTMG	RRTMG	Goddard
Boundary Layer	Yonsei Univeristy	Yonsei Univeristy	MYNN2
Cu_phycis	Grell 3D	Grell 3D	Grell 3D
Surface physics	Thermal diffusion	Unified Noah	LIS Noah 3.6
Aerosol-radiation	Yes	Yes	Yes
Aerosol-microphysics	Yes	Yes	Yes

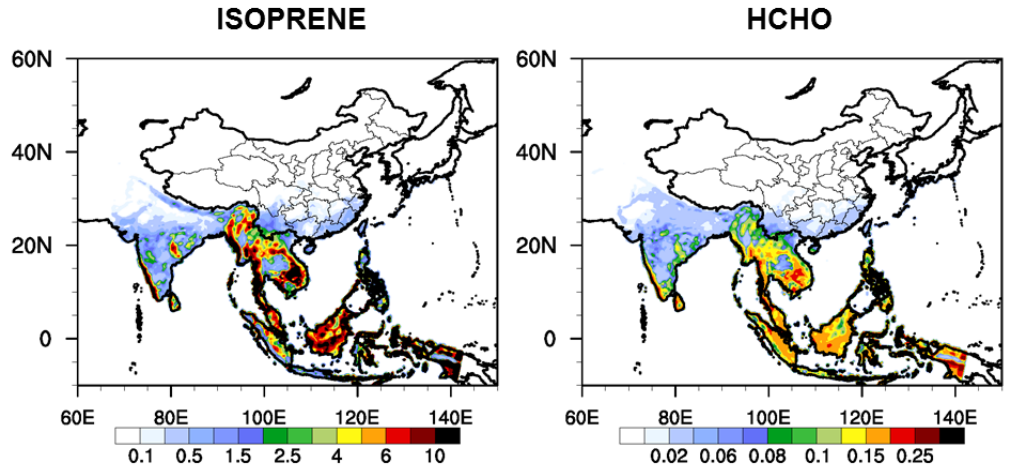

Figure S1. MEGAN biogenic emission inventory for January 2010 (moles/s/grid)

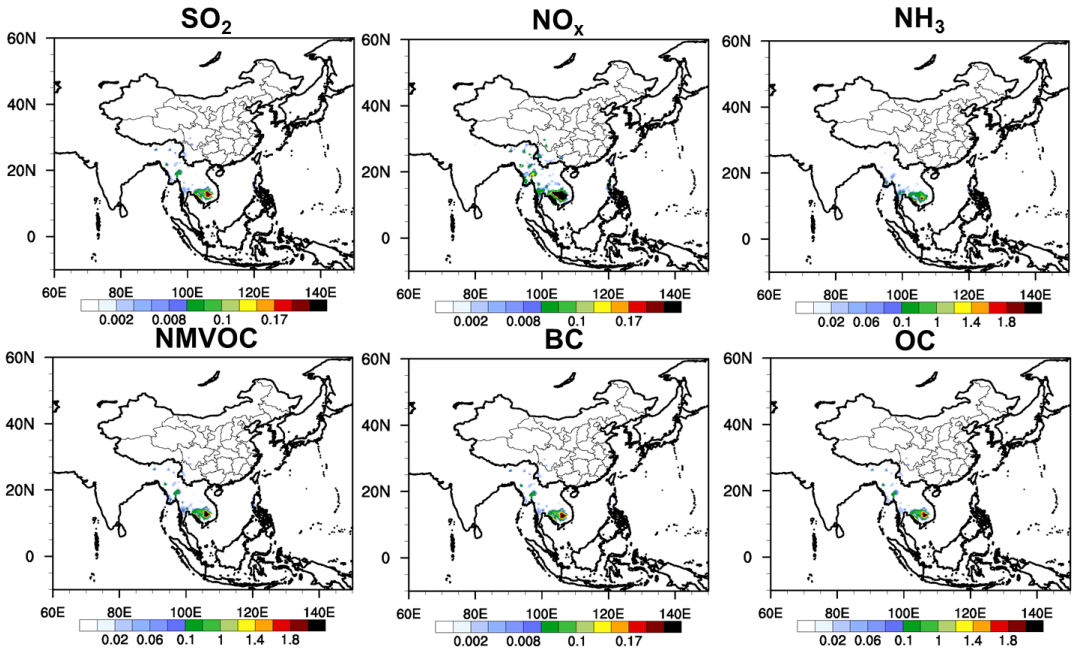

Figure S2. Re-gridded GFED biomass burning emissions (kg/s/grid)

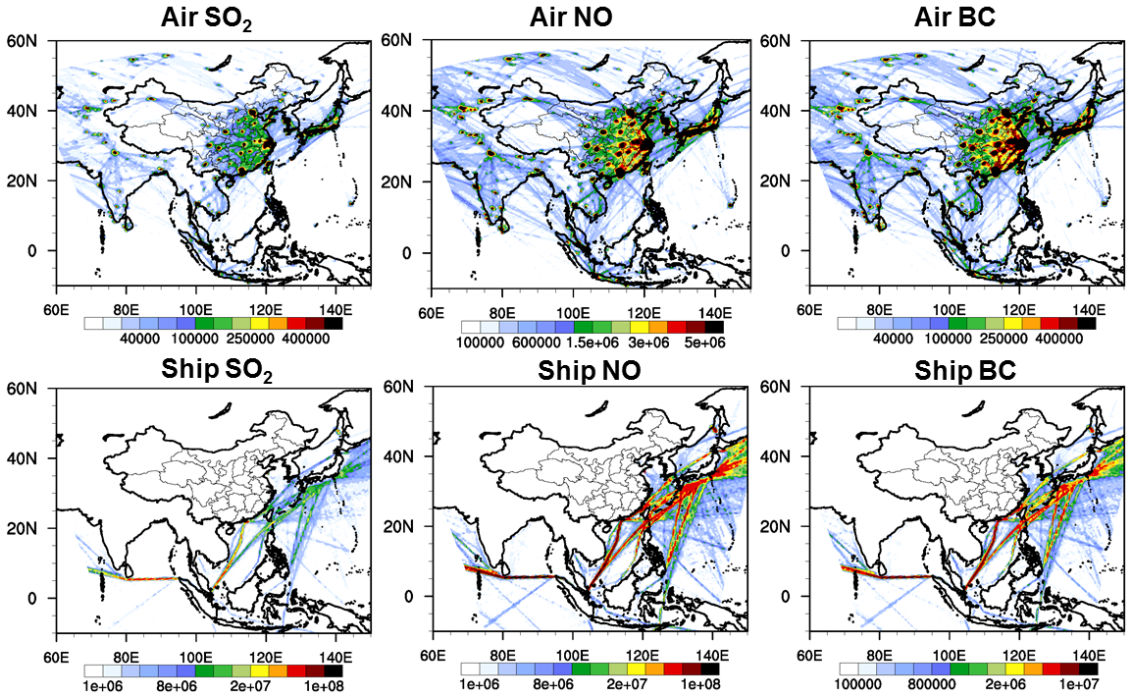

Figure S3. Air and ship emissions of SO_2, NO and BC (mole/grid/year for gas and g/grid/year for aerosol)

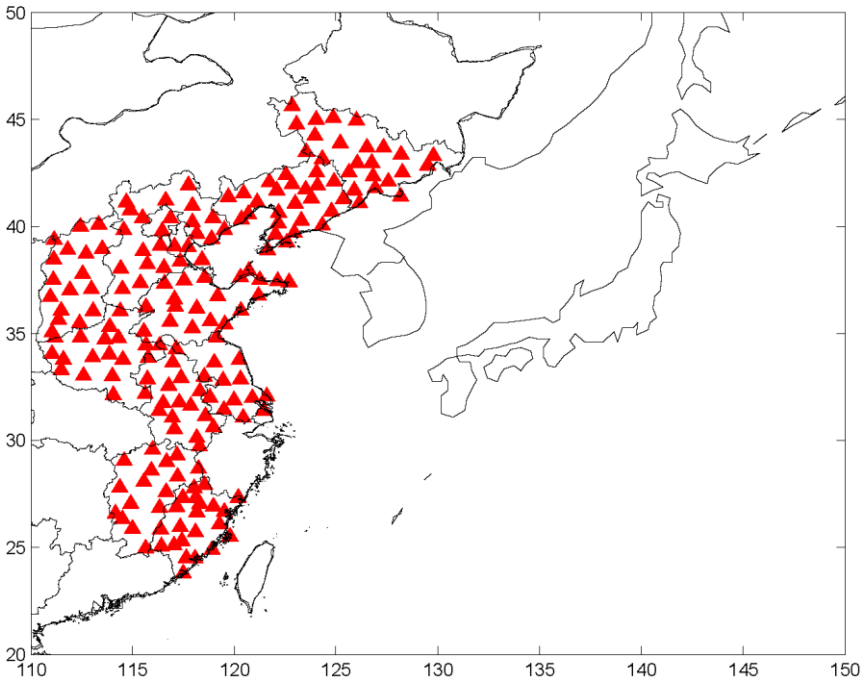

Figure S4. Locations of used meteorology measurements sites

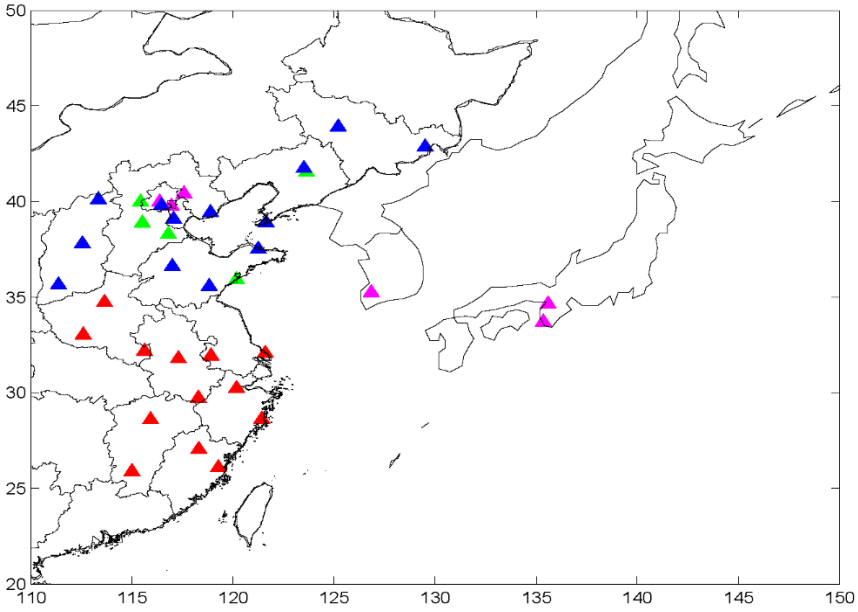

Figure S5. Locations of used radiation sites in North China (blue), radiation sites in South China (red), used CARE-China AOD measurements sites (green), and used AERONET AOD measurements sites (magneta)

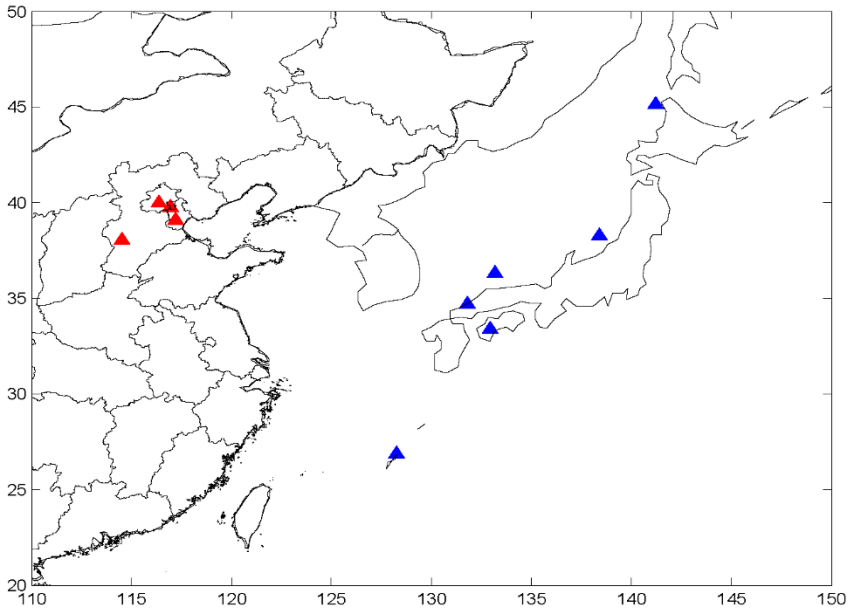

Figure S6. Locations of used CARE-China air quality measurements sites (red) and EANET sites (blue)

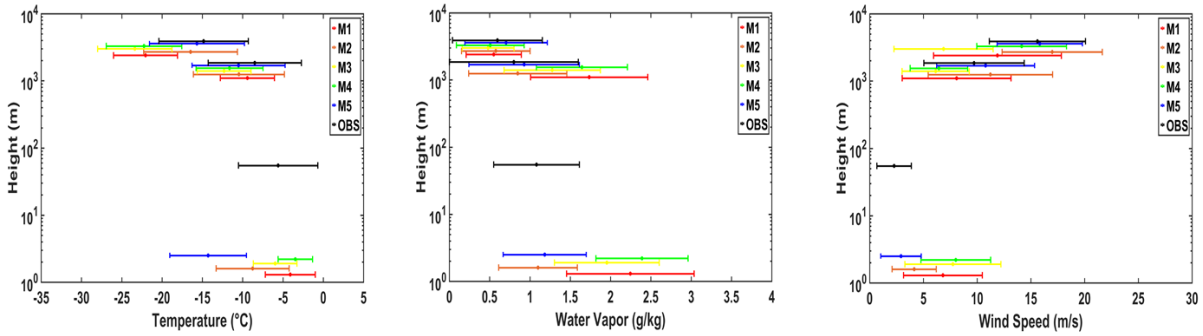

Figure S7. Comparisons of observed and predicted temperature, water vapor and wind speed at near surface, 1km and 3km (near surface observation is at 55m and model predictions are at 2m)

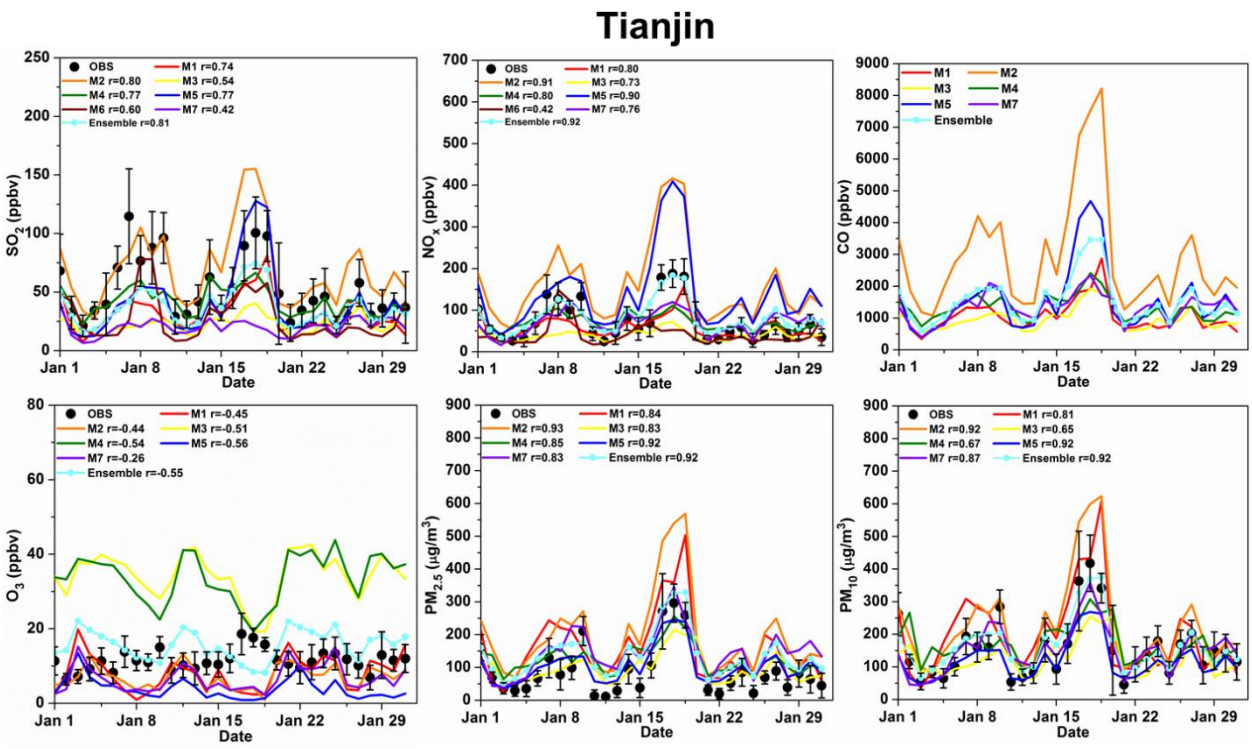

Figure S8. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, CO, O_3, $PM_{2.5}$ and PM_{10}) at the Tianjin CARE-China site

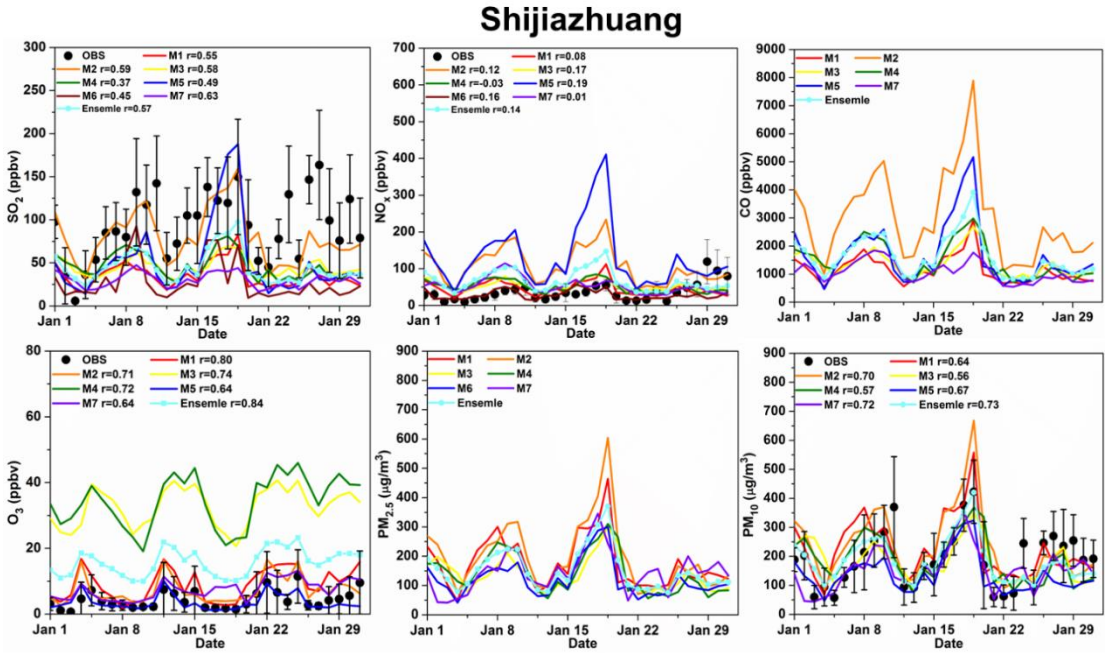

Figure S9. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, CO, O_3, $PM_{2.5}$ and PM_{10}) at the Shijiazhuang CARE-China site

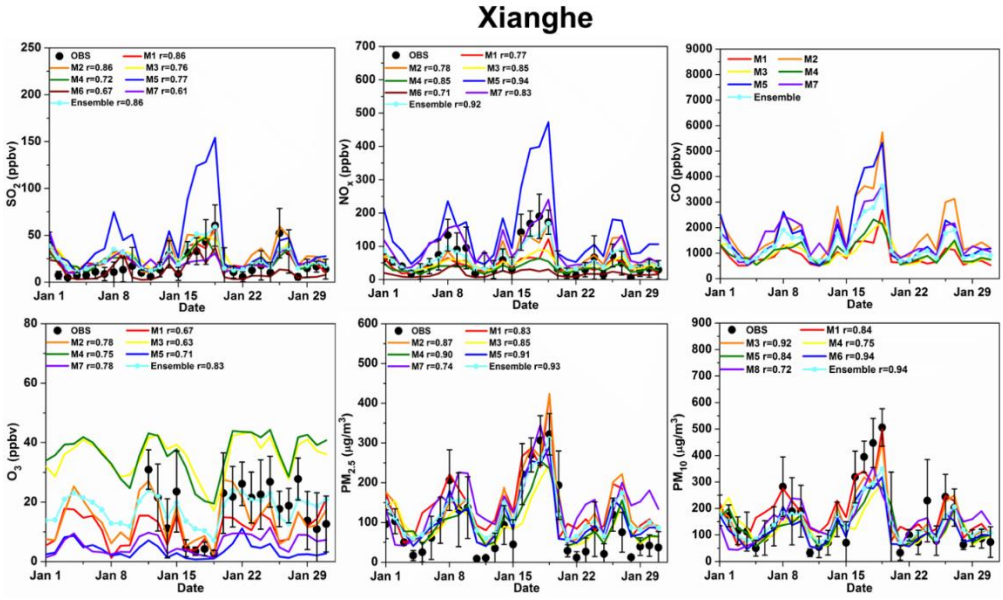

Figure S10. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, CO, O_3, $PM_{2.5}$ and PM_{10}) at the Xianghe CARE-China site

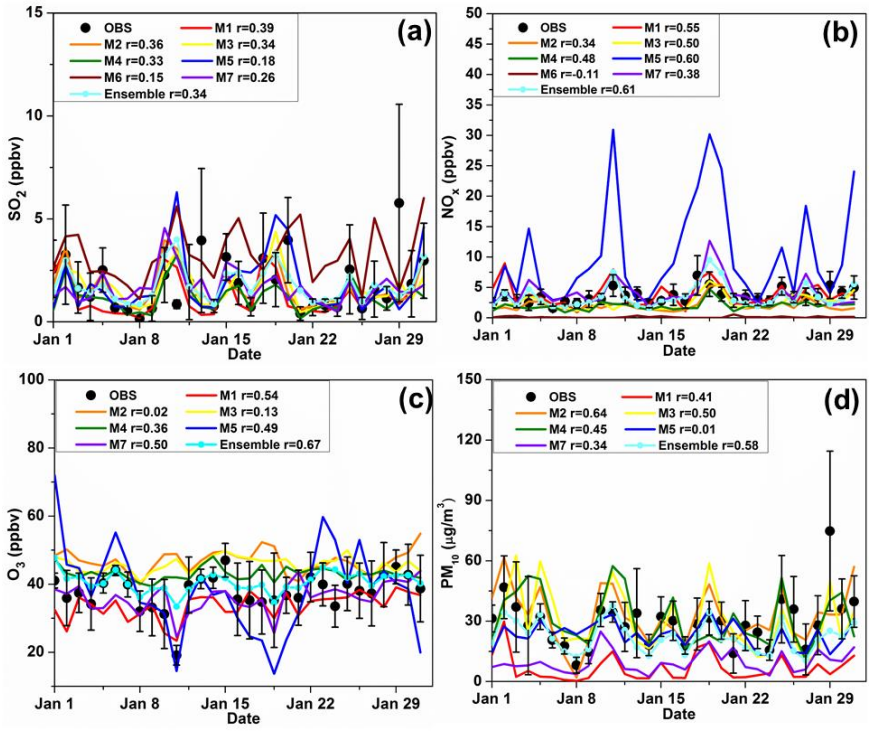

Figure S11. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, O_3, and PM_{10}) at the Barnryu EANET sites

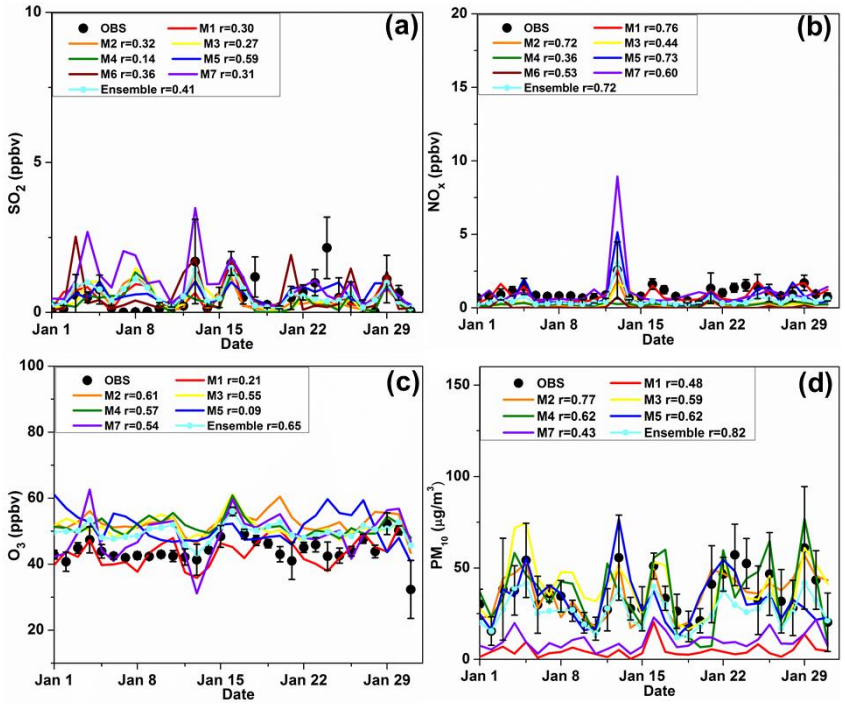

Figure S12. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, O_3, and PM_{10}) at the Hedo EANET sites

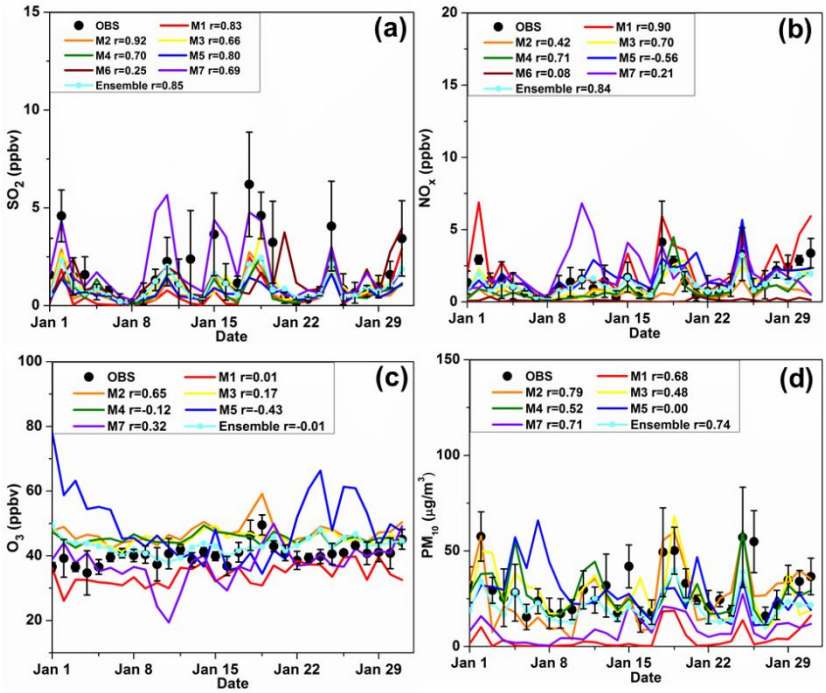

Figure S13. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, O_3, and PM_{10}) at the Oki EANET sites

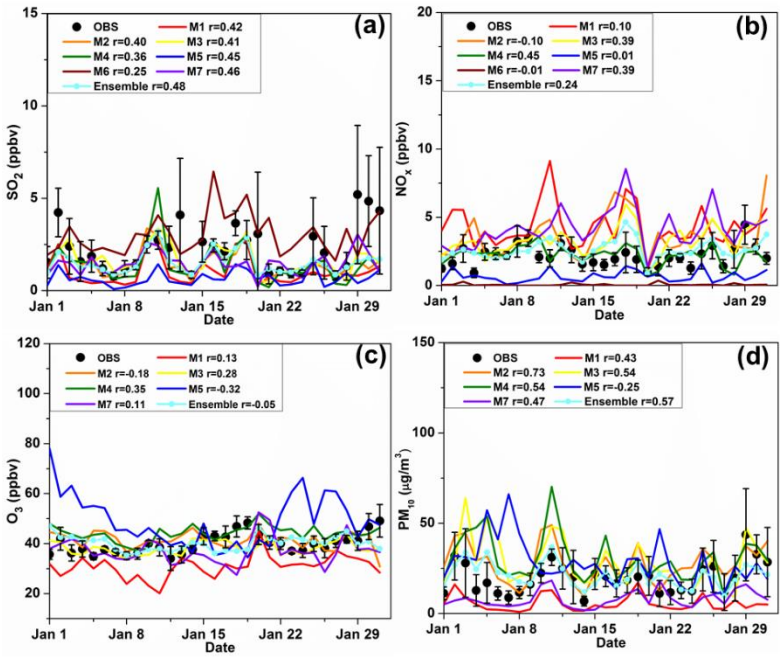

Figure S14. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, O_3, and PM_{10}) at the Yusuhara EANET sites

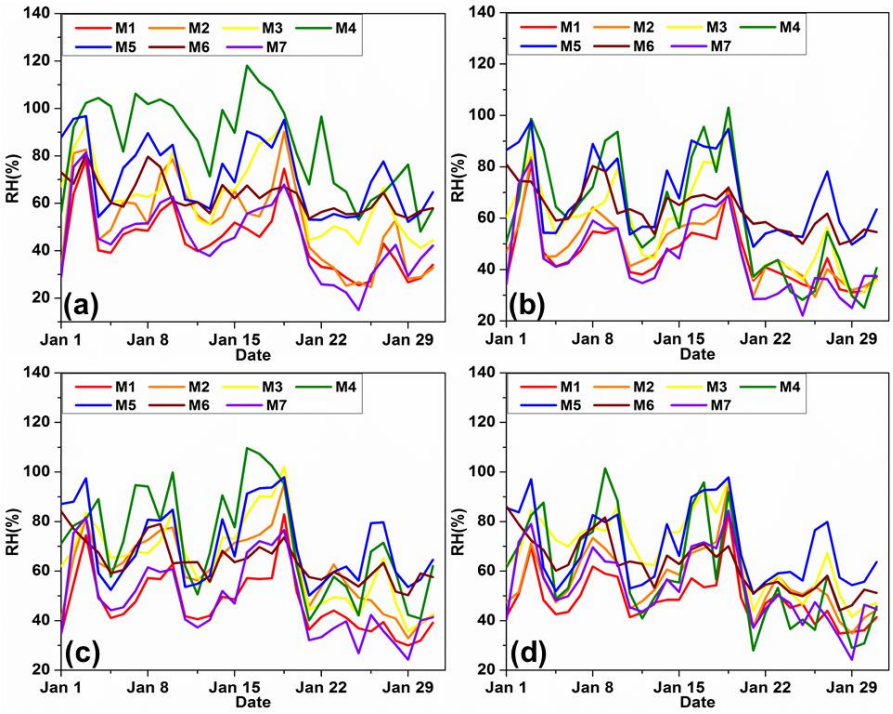

Figure S15. Inter-comparisons of simulated daily mean RH at the Beijing (a), Baoding (b), Xianghe (c) and Xinglong (d) AOD site