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Air quality and climate change, Topic 3 of the Model Inter-Comparison Study for Asia Phase III (MICS-Asia III) – Part 1: 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.

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

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

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

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

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

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

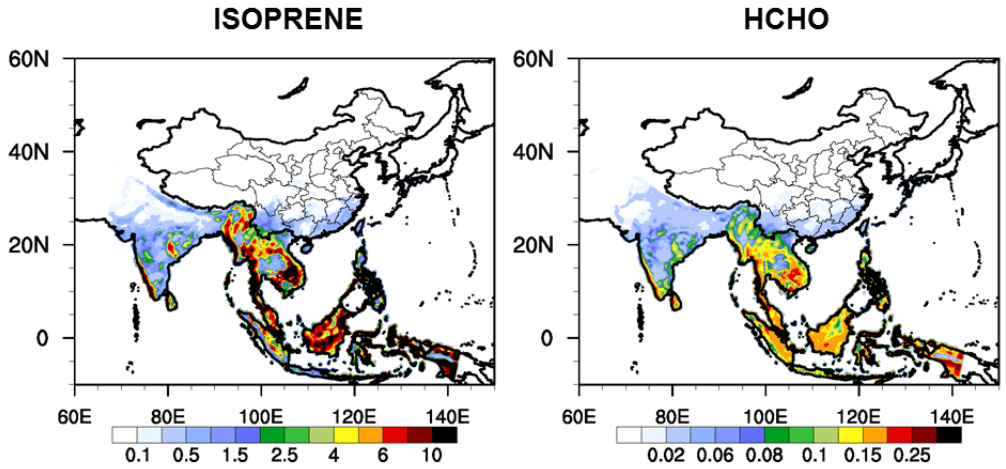

Figure S1. MEGAN biogenic emission inventory for January 2010 (moles/s/grid)

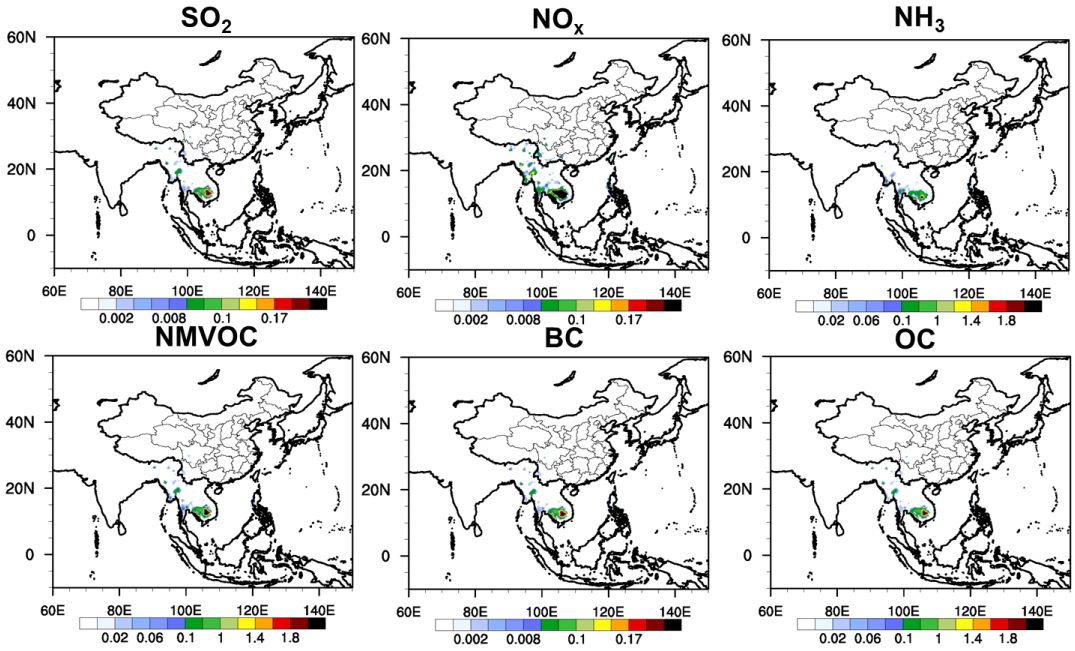

Figure S2. Re-gridded GFED biomass burning emissions (kg/s/grid)

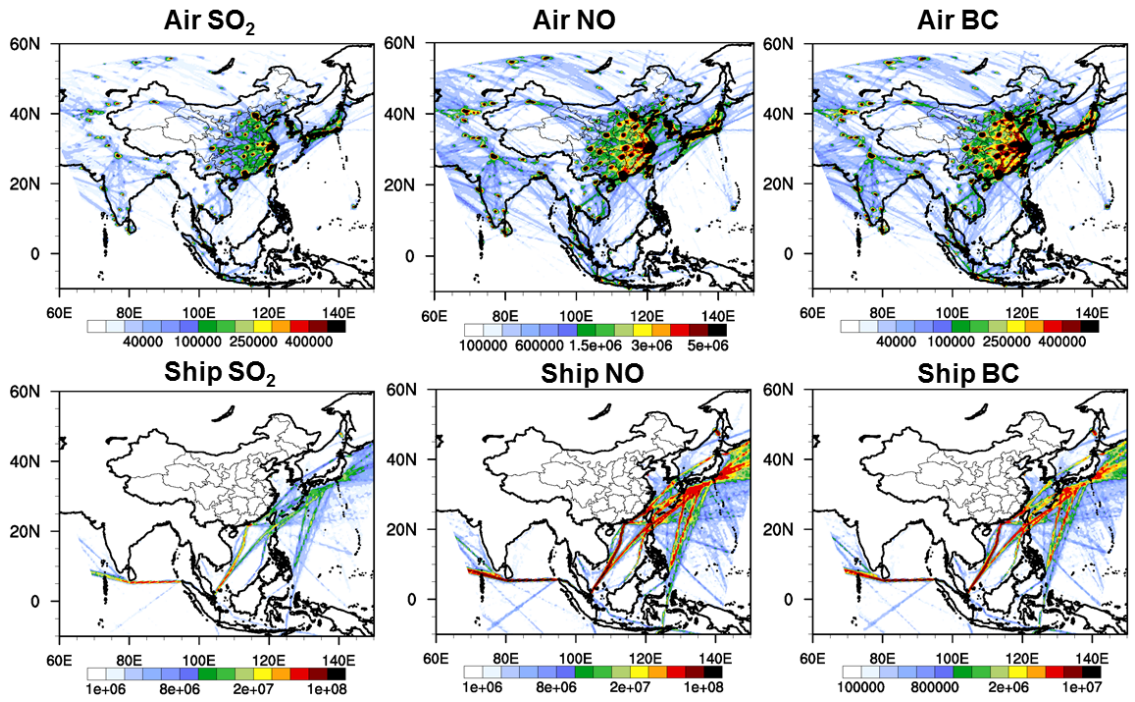

Figure S3. Air and ship emissions of SO_2, NO and BC (mole/grid/year for gas and g/grid/year for aerosol)

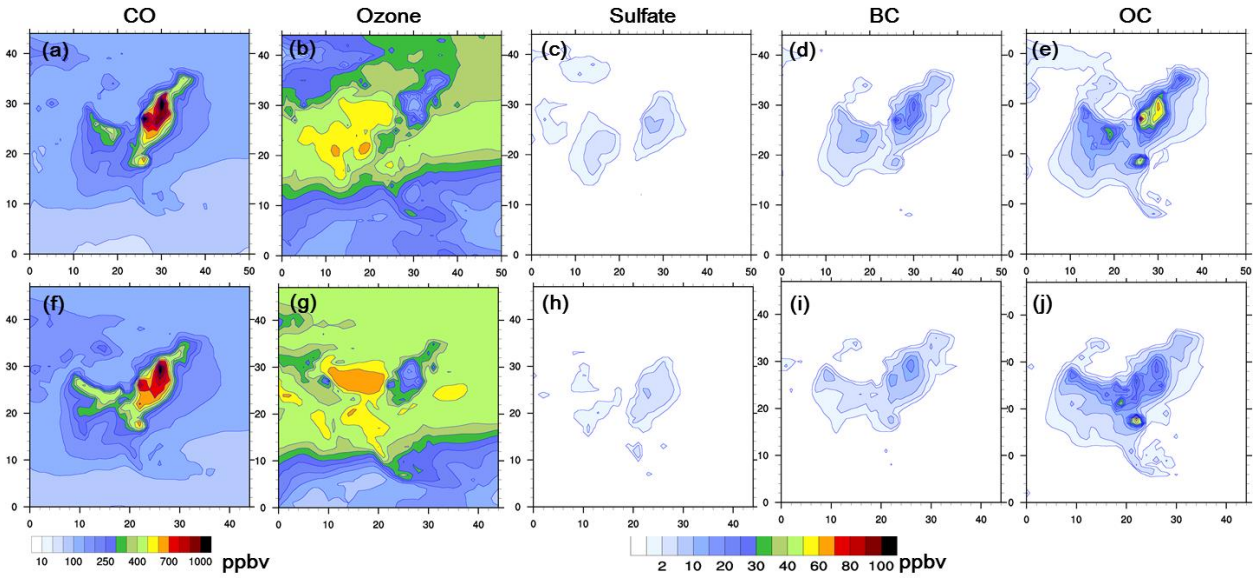

Figure S4. Monthly mean near surface CO, ozone, sulfate, BC and OC from GEOS-Chem (a-e) and MOZART (f-i)

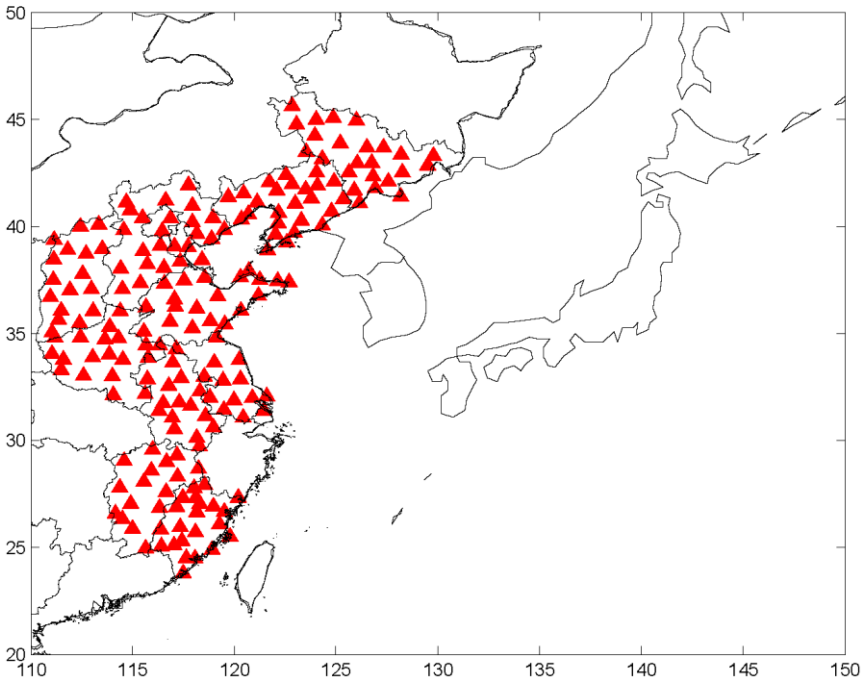

Figure S5. Locations of used meteorology measurements sites

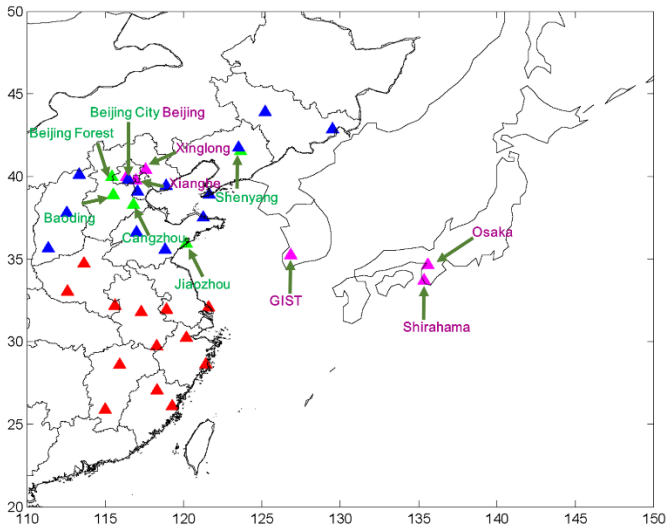

Figure S6. Locations of used radiation sites in North China (blue), radiation sites in South China (red), used CARE-China AOD measurements sites (green), and used AERONET AOD measurements sites (magneta)

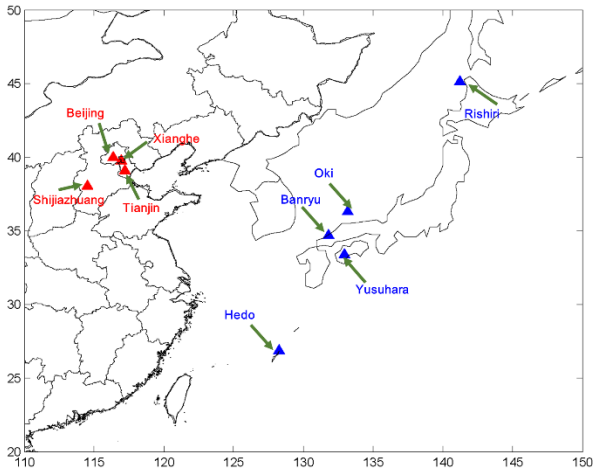

Figure S7. Locations of used CARE-China air quality measurements sites (red) and EANET sites (blue)

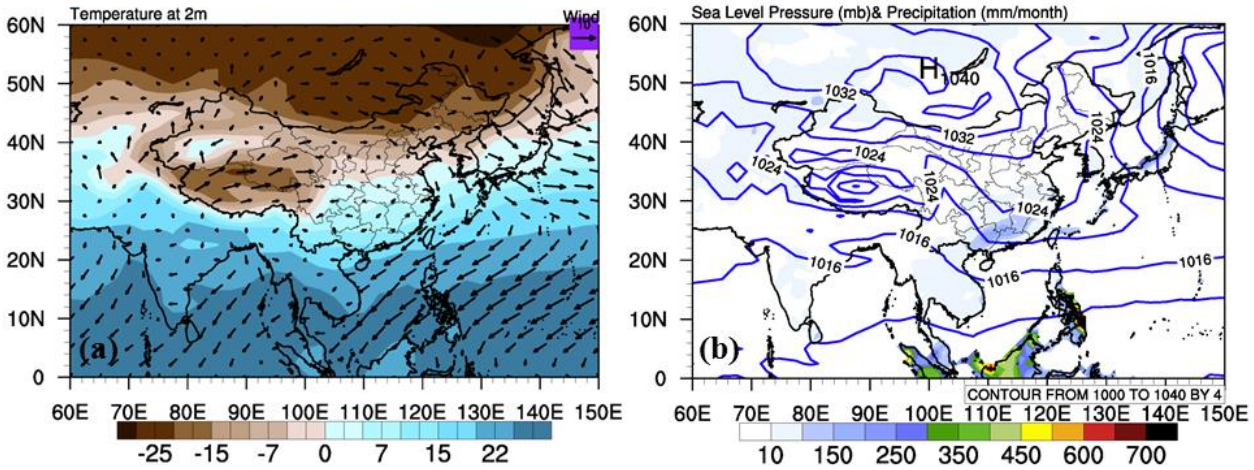

Figure S8. Monthly mean temperature at 2m, winds at 10m, total precipitation and sea level pressure for January 2010

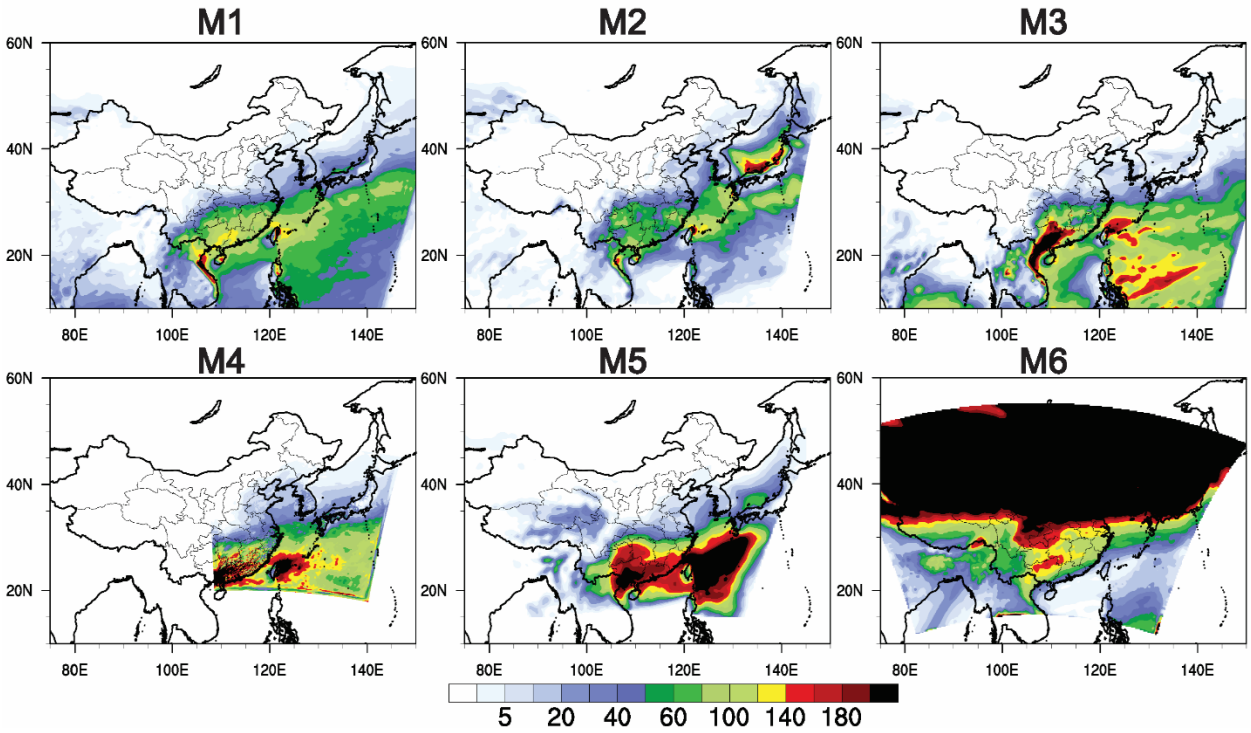

Figure S9. Monthly mean liquid water path predicted by participating models (g/m^2)

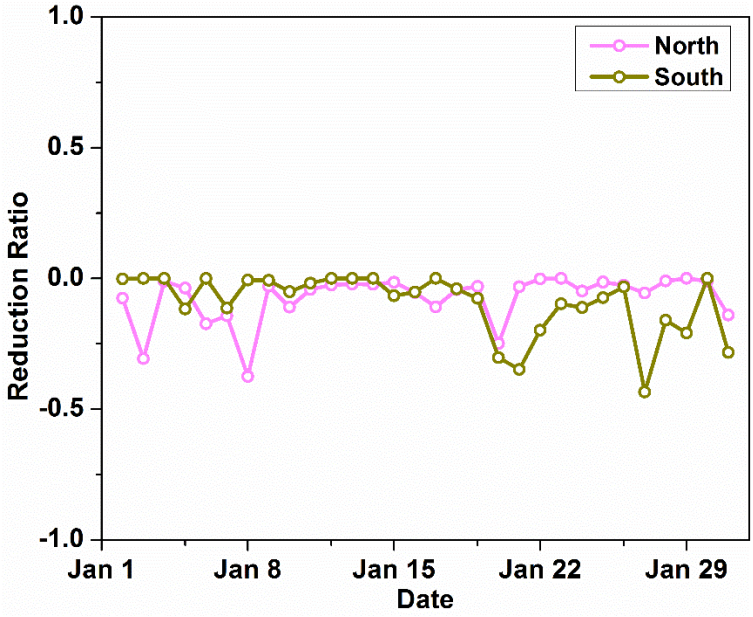

Figure S10. Monthly mean liquid water path predicted by M2 (g/m^2)

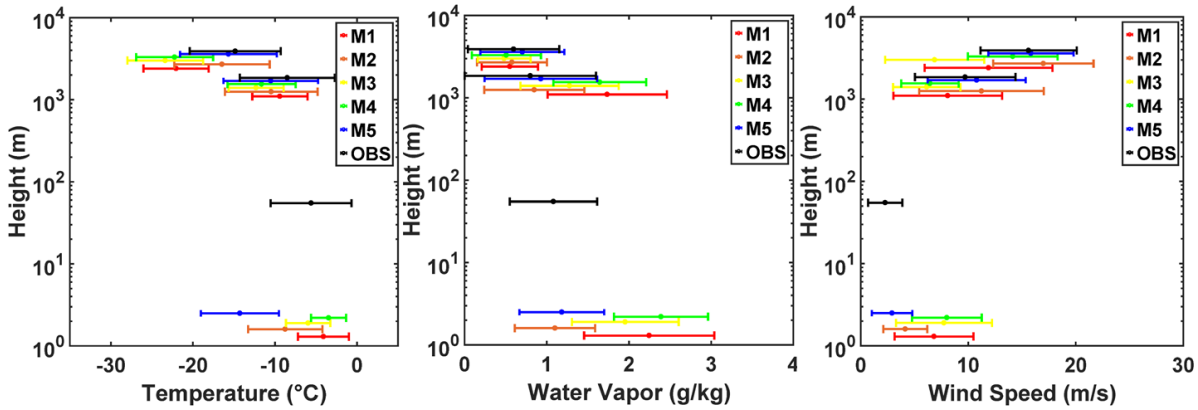

Figure S11. Comparisons of observed and predicted monthly mean temperature, water vapor and wind speed at near surface, 1km and 3km (near surface observation is at 55m and model predictions are at 2m; comparisons are conducted at near surface, 1km and 3km; shifts in heights are made to make it clearer to avoid overlapping)

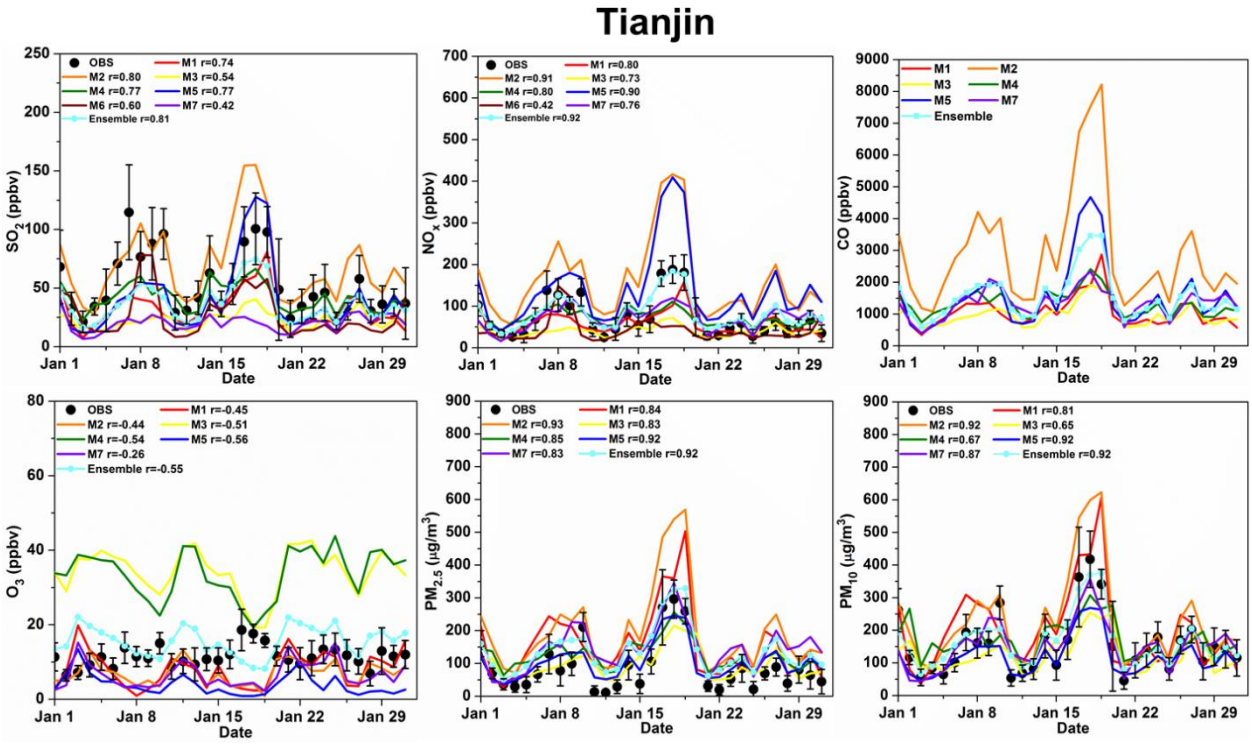

Figure S12. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, CO, O_3, $PM_{2.5}$ and PM_{10}) at the Tianjin CARE-China site

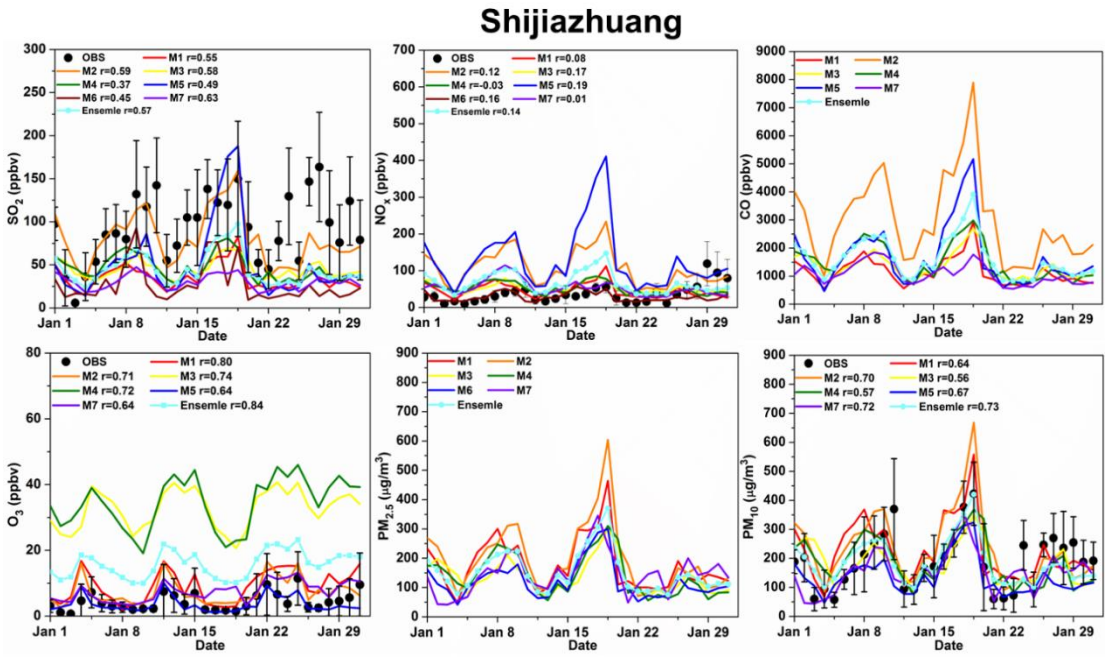

Figure S13. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, CO, O_3, $PM_{2.5}$ and PM_{10}) at the Shijiazhuang CARE-China site

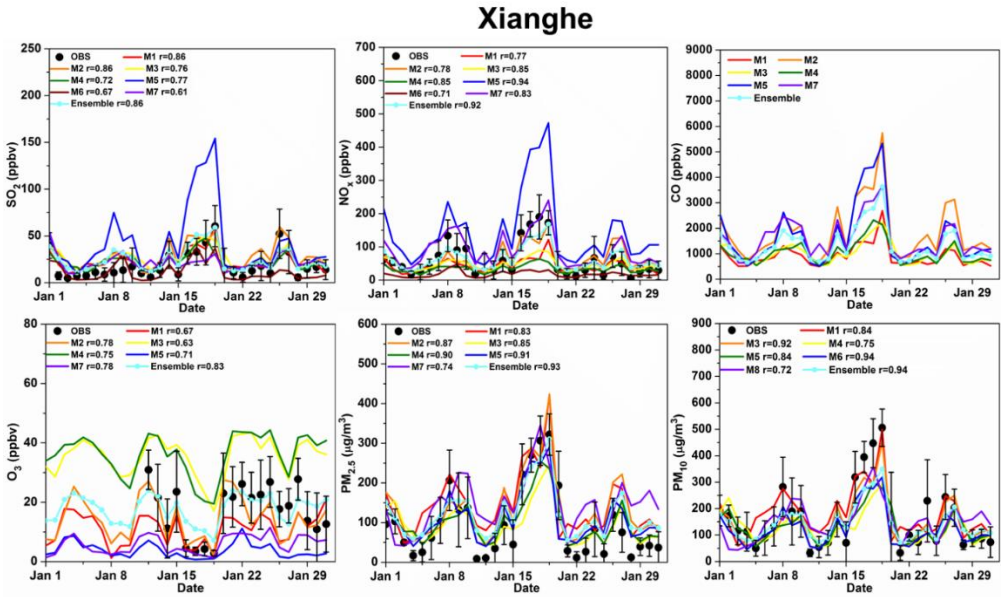

Figure S14. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, CO, O_3, $PM_{2.5}$ and PM_{10}) at the Xianghe CARE-China site

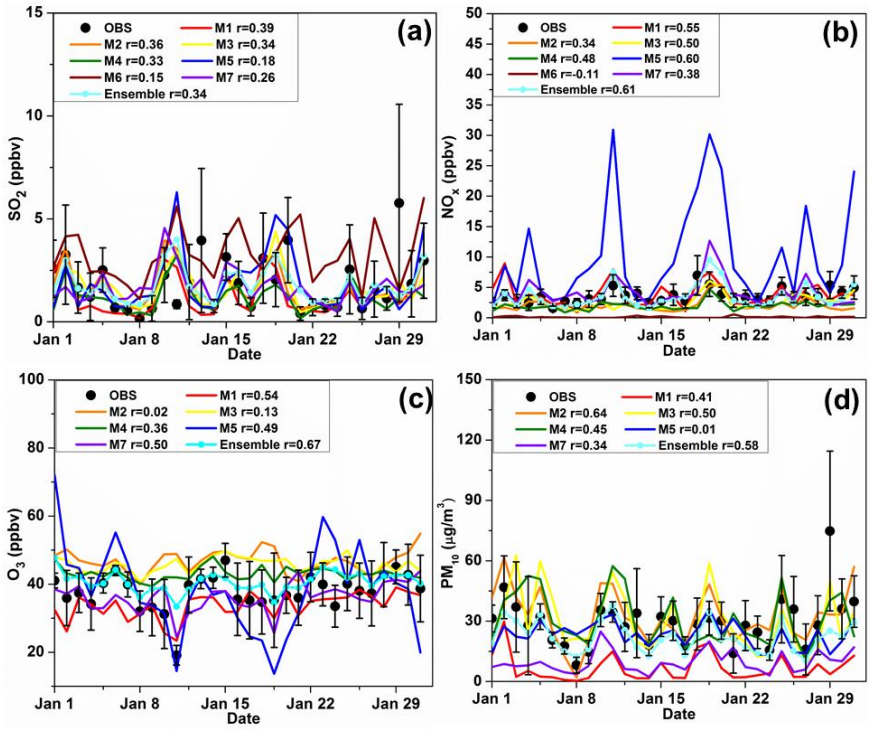

Figure S15. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, O_3, and PM_{10}) at the Banryu EANET sites

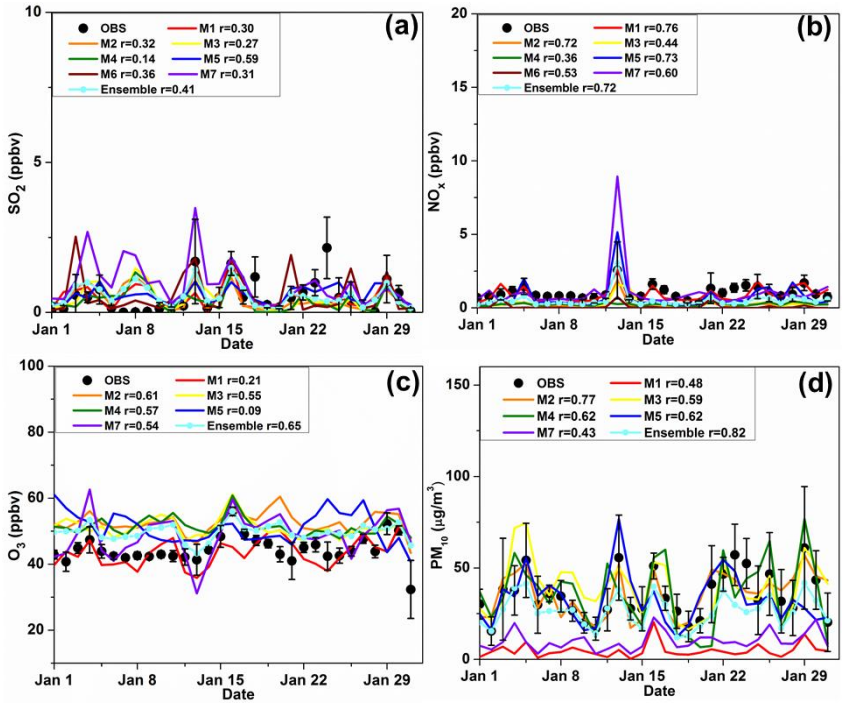

Figure S16. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, O_3, and PM_{10}) at the Hedo EANET sites

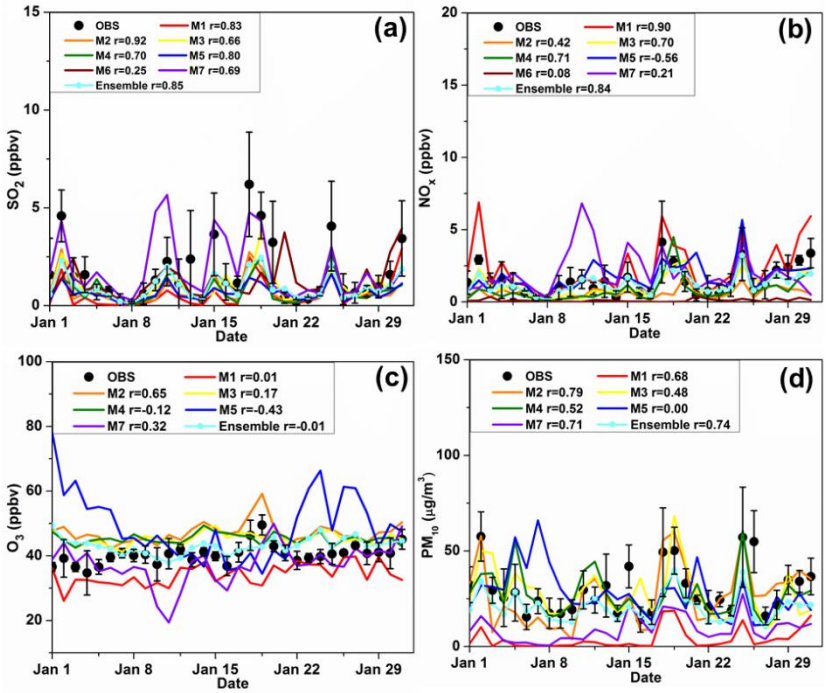

Figure S17. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, O_3, and PM_{10}) at the Oki EANET sites

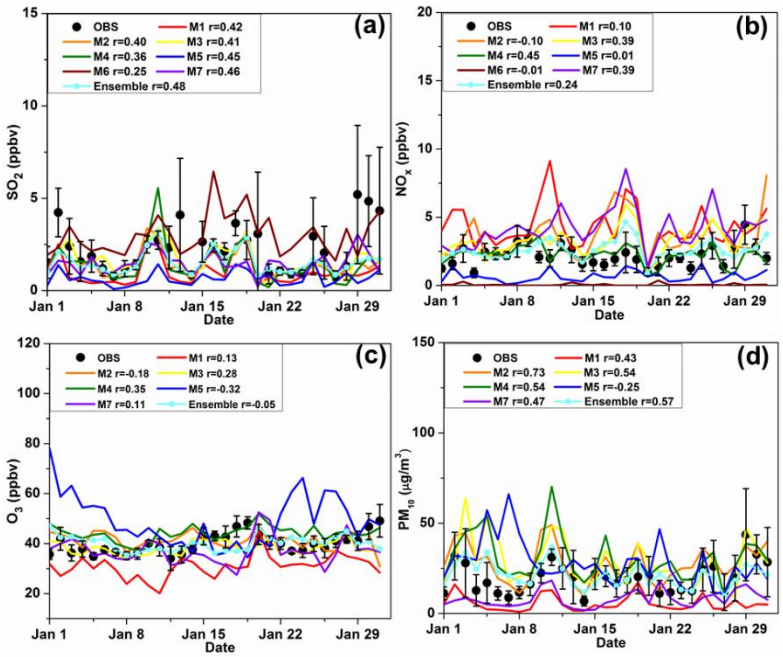

Figure S18. Comparisons between simulated and observed daily air pollutants (SO_2, NO_x, O_3, and PM_{10}) at the Yusuhara EANET sites

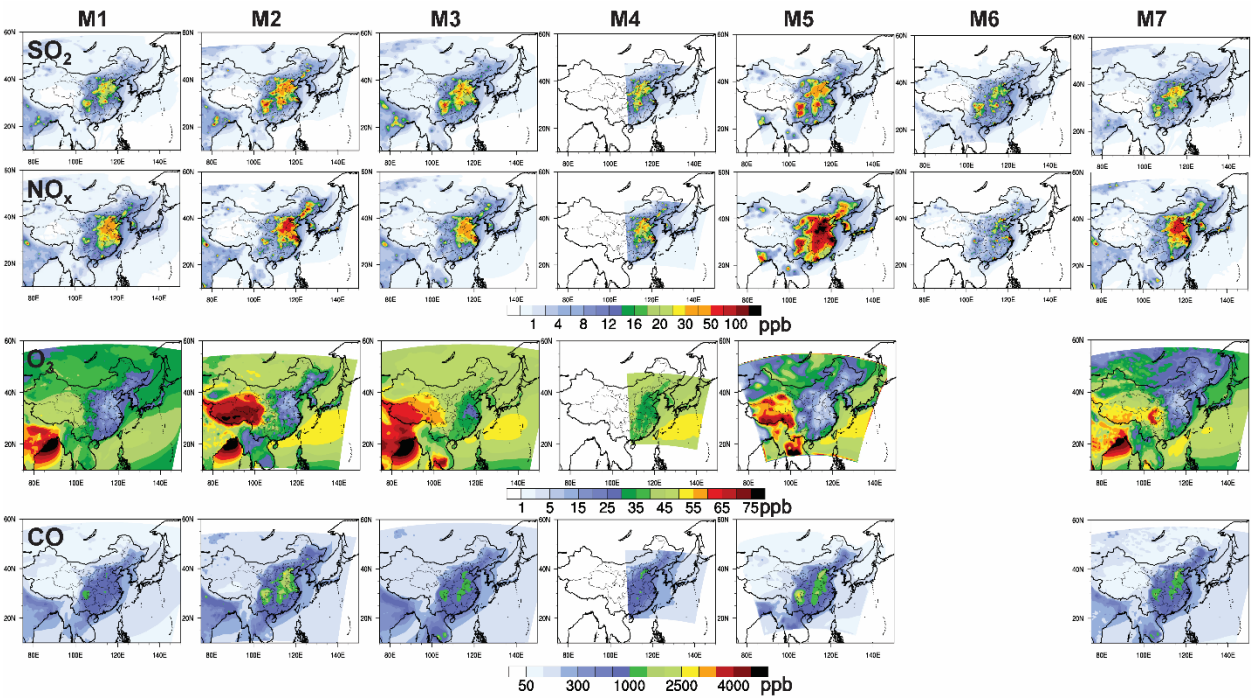

Figure S19. Simulated monthly concentrations of SO_2, NO_x, O_3 and CO for January 2010 from all participating models

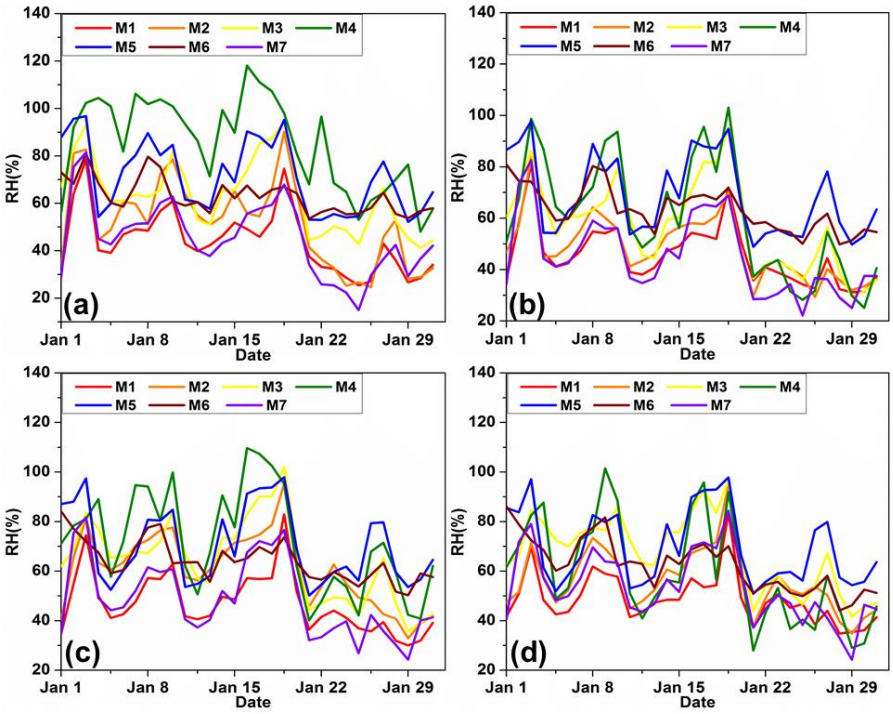

Figure S20. Inter-comparisons of simulated daily mean RH at the Beijing (a), Baoding (b), Xianghe (c) and Xinglong (d) AOD sites