Supplement of

Sensitivity Studies of Four-Dimensional Local Ensemble Transform Kalman Filter Coupled With WRF-Chem Version 3.9.1 for Improving Particulate Matter Simulation Accuracy
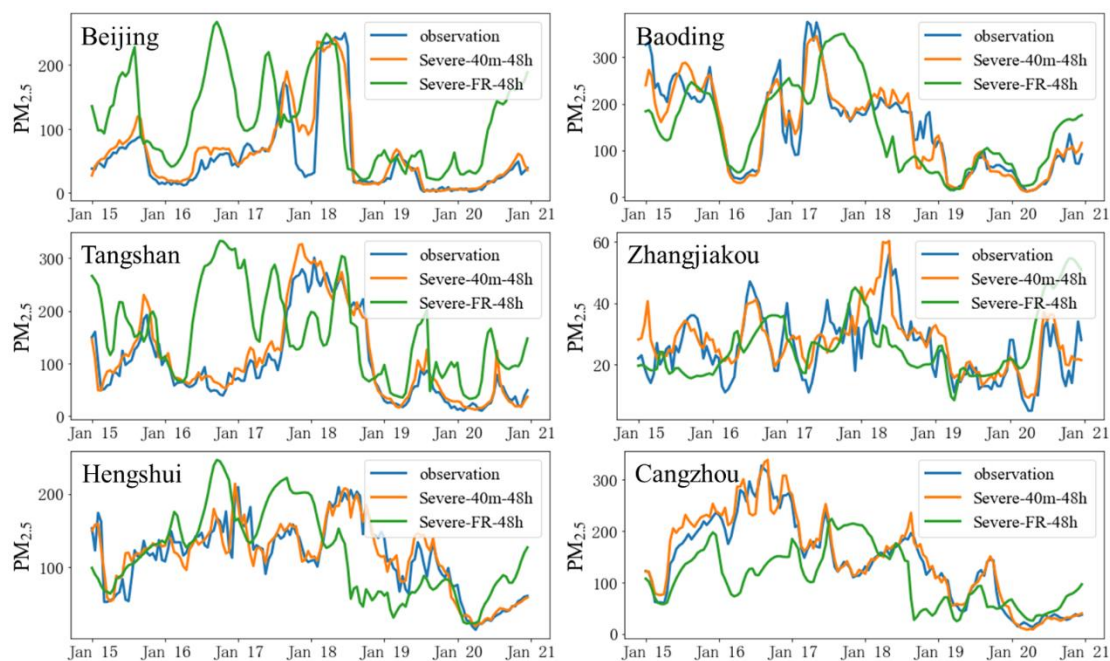
Figure S1. Temporal variations of $PM_{2.5}$ from Severe-40m-48h, Severe-FR-48h and

observation at six independent verification stations (units: μg m^{-3}).
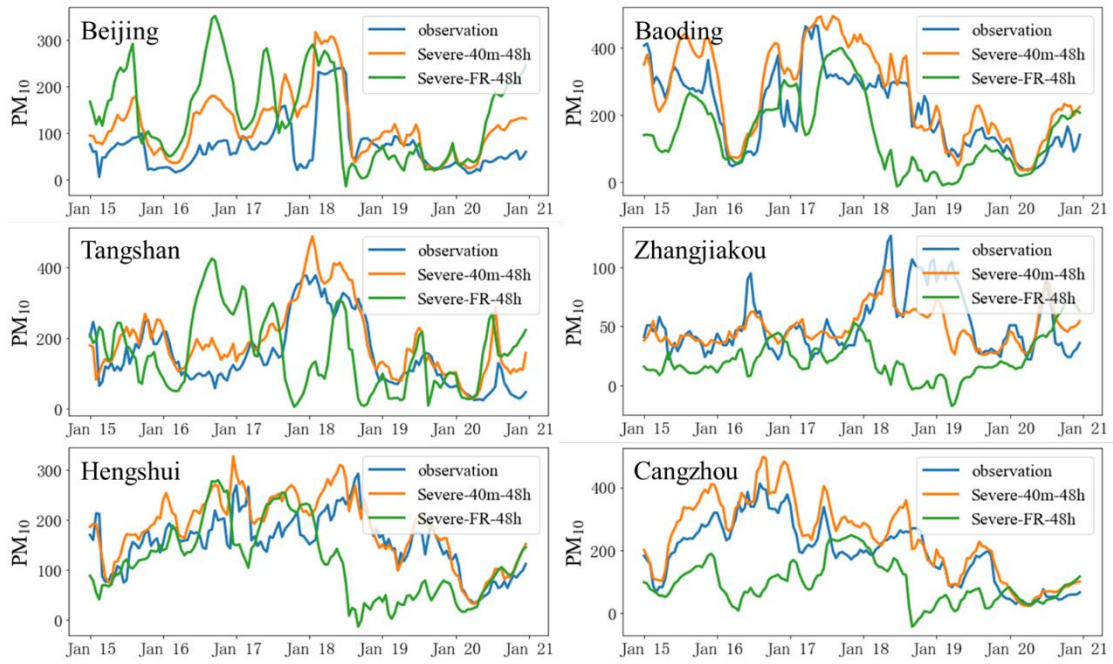
Figure S2. Similar with Figure S2 but for PM$_{10}$.
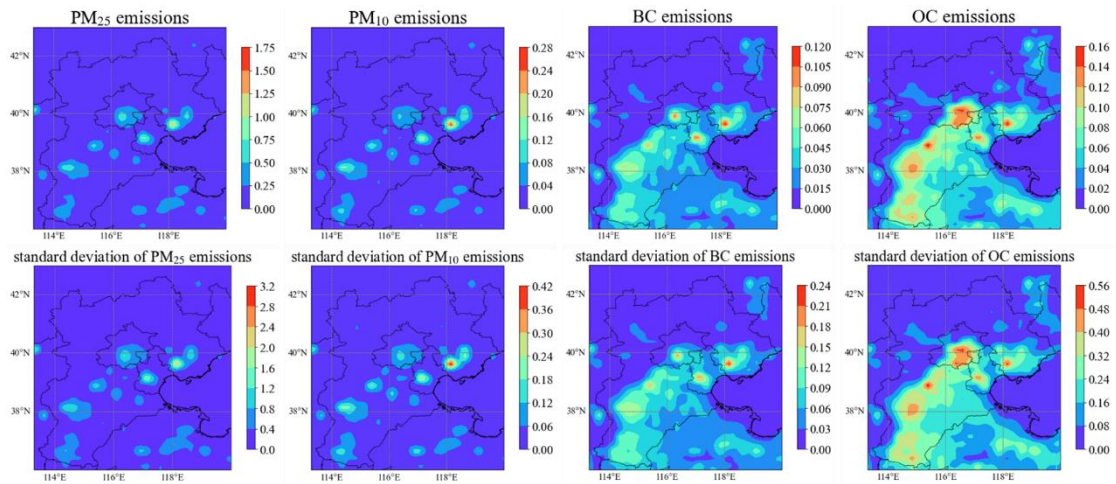
Figure S3. Contour maps about spatial distribution of anthropogenic PM$_{2.5}$, PM$_{10}$, BC and OC

emissions in first row (units: μg m^{-2} s^{-1}) and their standard deviations calculated from 40

ensemble members in second row.
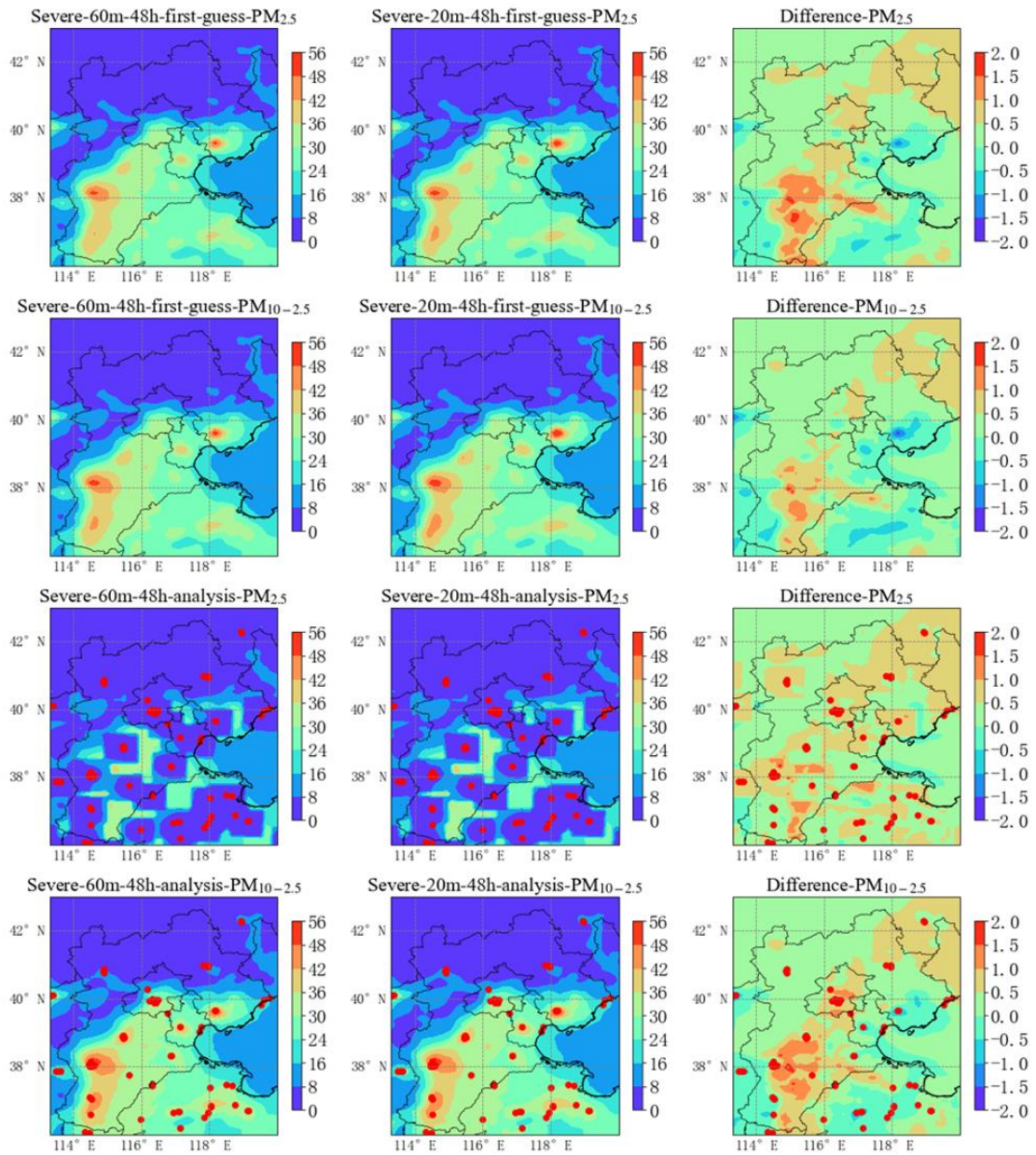
Figure S4. Contour maps of spatial distributions of temporal averaged $PM_{2.5}$ and $PM_{10-2.5}$

standard deviations in the first guess (first and second row) and analysis (third and fourth

row) of (Severe-60m-48h minus Severe-20m-48h) within simulation period (units: $\mu g\ m^{-3}$).

The red dots in analysis of $PM_{2.5}$ and $PM_{10-2.5}$ implies the location of assimilated stations.
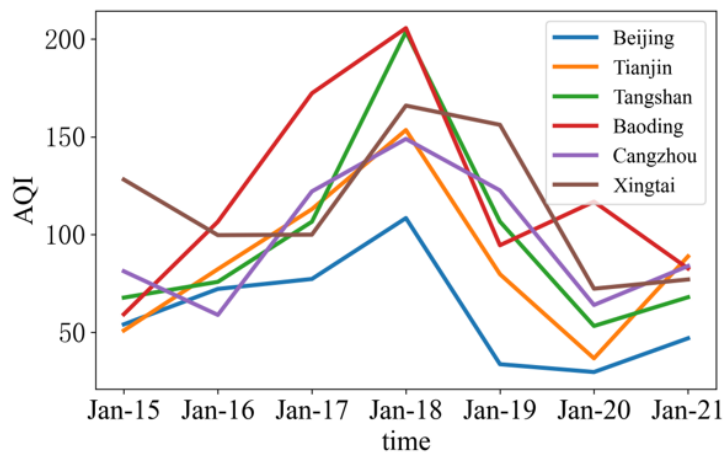
Figure S5. Temporal variation about air quality index at six representative sites in moderate

haze event.
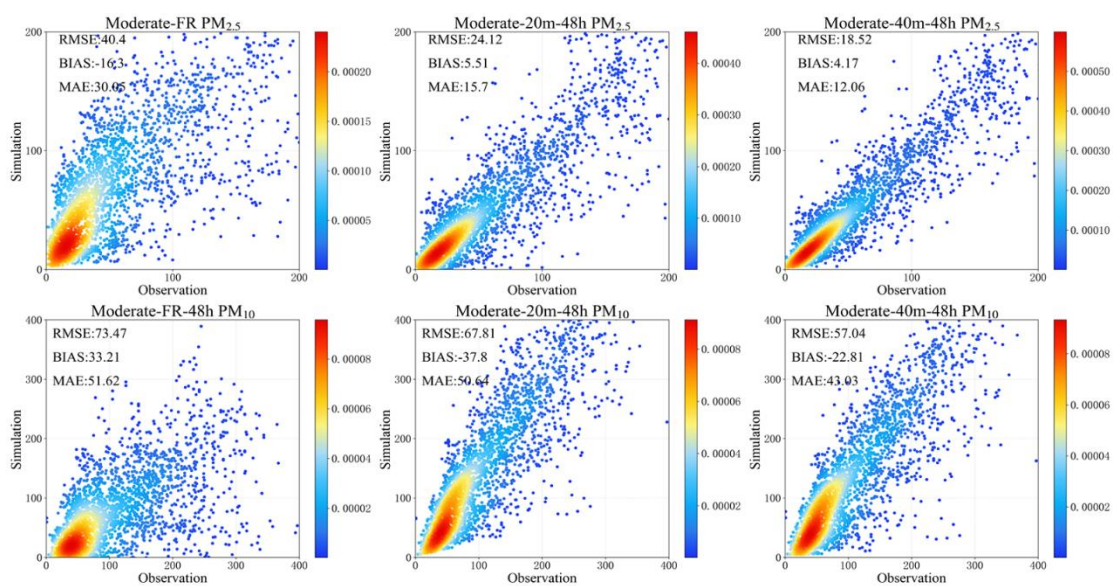
Figure S6. Scatter and density plots of $PM_{2.5}$ and PM_{10} observations from verification

stations versus those in Moderate-FR-48h, Moderate-20m-48h and Moderate-40m-48h (units:

$\mu g\ m^{-3}$).
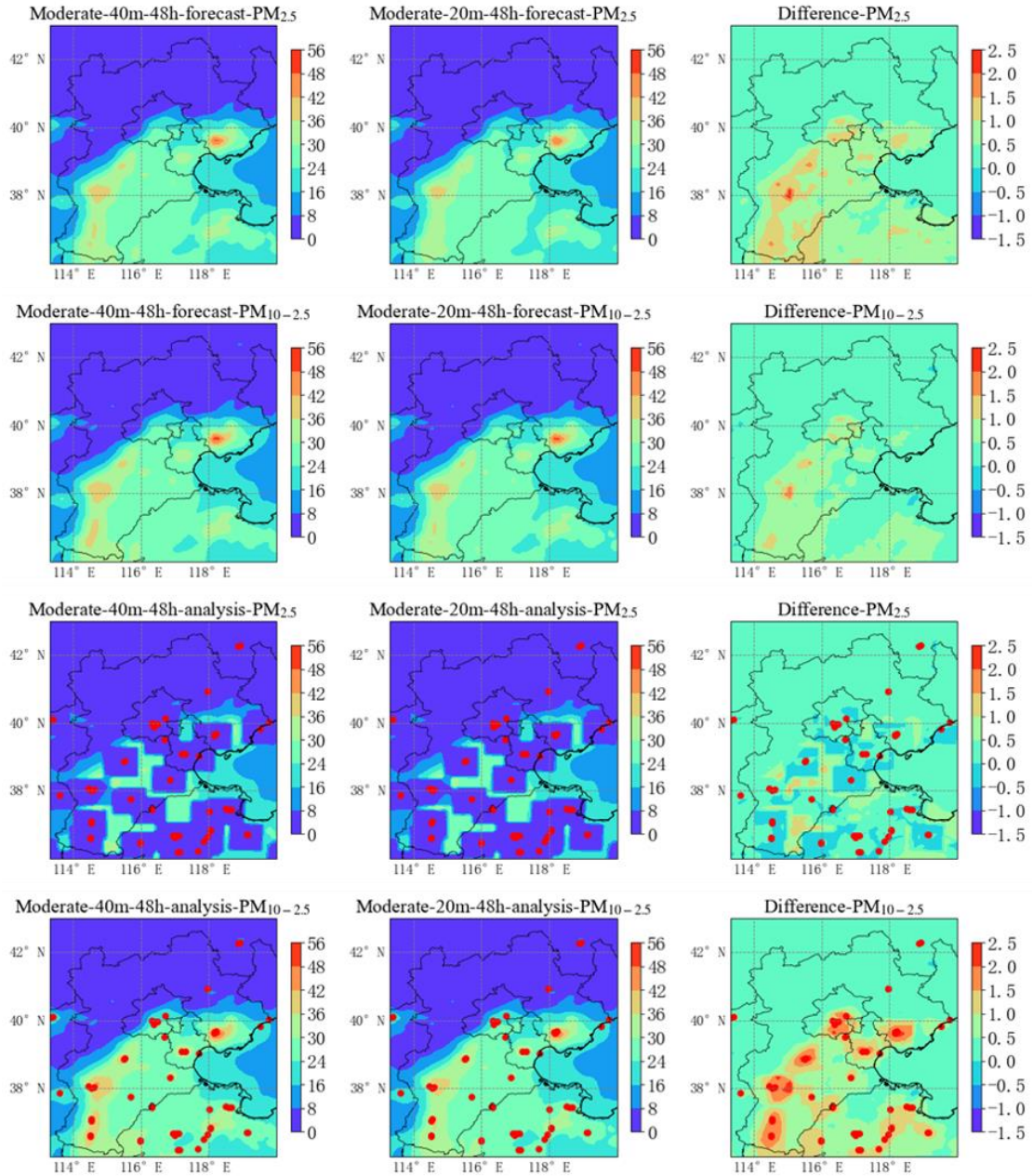
Figure S7. Contour maps of spatial distributions of temporal averaged $PM_{2.5}$ and $PM_{10\text{-}2.5}$ standard deviations in the first guess (first and second row) and analysis (third and fourth row) of Moderate-40m-48h, Moderate-20m-48h and their difference (Moderate-40m-48h minus Moderate-20m-48h) in a moderate haze event (units: $\mu g\ m^{-3}$). The red dots in analysis of $PM_{2.5}$ and $PM_{10\text{-}2.5}$ implies the location of assimilated stations.