# Supplementary Information for the Manuscript Data Assimilation of Ambient Concentrations of Multiple Air Pollutants Using an Emission-Concentration Response Modeling Framework

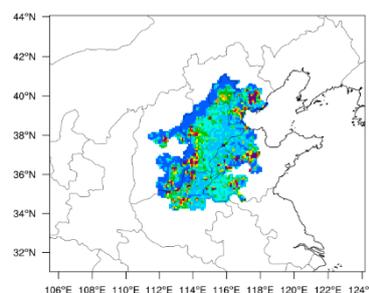**Table 1.** Number of Sites Used for Nudging in Each City.

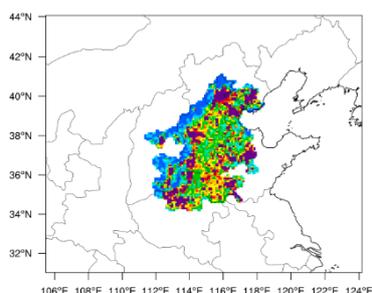|	B T J J	B J D	CA Z	H D	H S	L F	SJ Z	T S	X T	T Y	Y Q	Z Z	J Z	A Y	H B	X X	K F	P Y	H Z	L C	D Z	J N	Z B	J N	B Z	J C	CH Z	TO T
JAN	12 8	5	2	2	3	2	2	1	1	6	1	3	2	6	2	2	2	2	2	1	6	2	1	4	2	2	1	85
APR	12 11	5	2	4	3	2	2	1	1	6	1	3	2	4	3	2	2	2	2	1	6	2	1	4	2	2	2	90
JUL	12 11	5	2	4	3	2	2	1	1	6	1	3	2	6	3	2	3	2	2	1	6	2	1	4	1	3	2	93
OCT	3 9	5	2	4	3	2	2	1	1	6	1	3	2	6	3	2	2	2	2	1	6	1	1	4	1	3	2	80
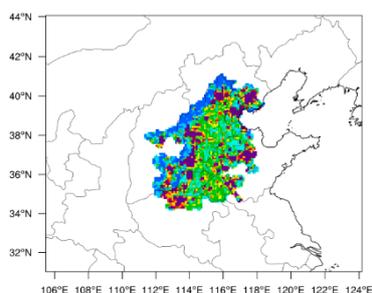
(a) NO_x
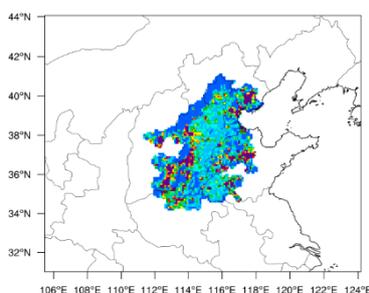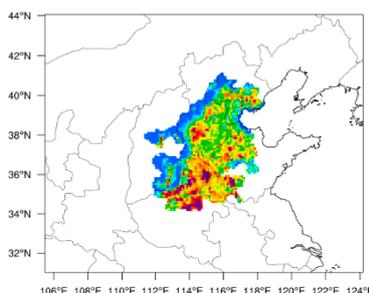

(b) SO_2

(c) $pPM_{2.5}$

(d) VOC

(e) NH_3

Figure S1. Spatial distribution of five air pollutants emissions of 28 cities in NCP (unit: $kt \cdot grid^{-1} \cdot yr^{-1}$).
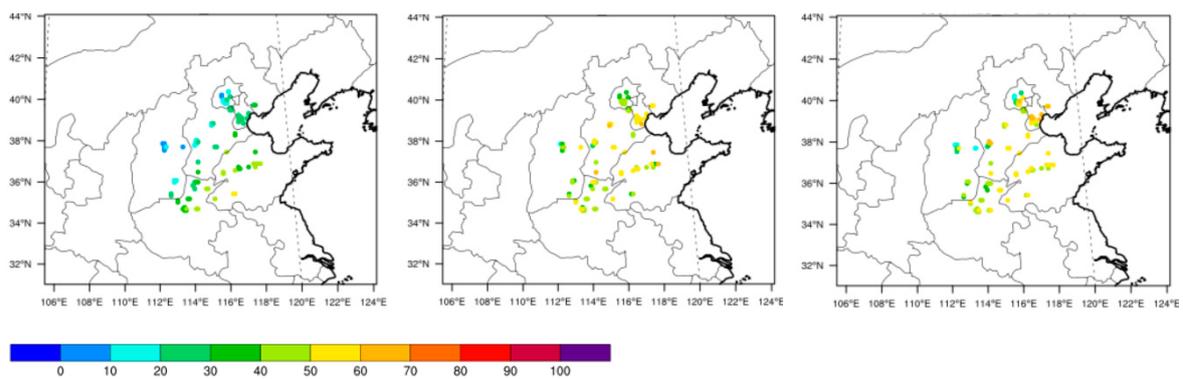
Figure S2. Comparions of CMAQ-simulated, observed, and RSM-assimilated PM2.5 concentrations in Apr 2017.
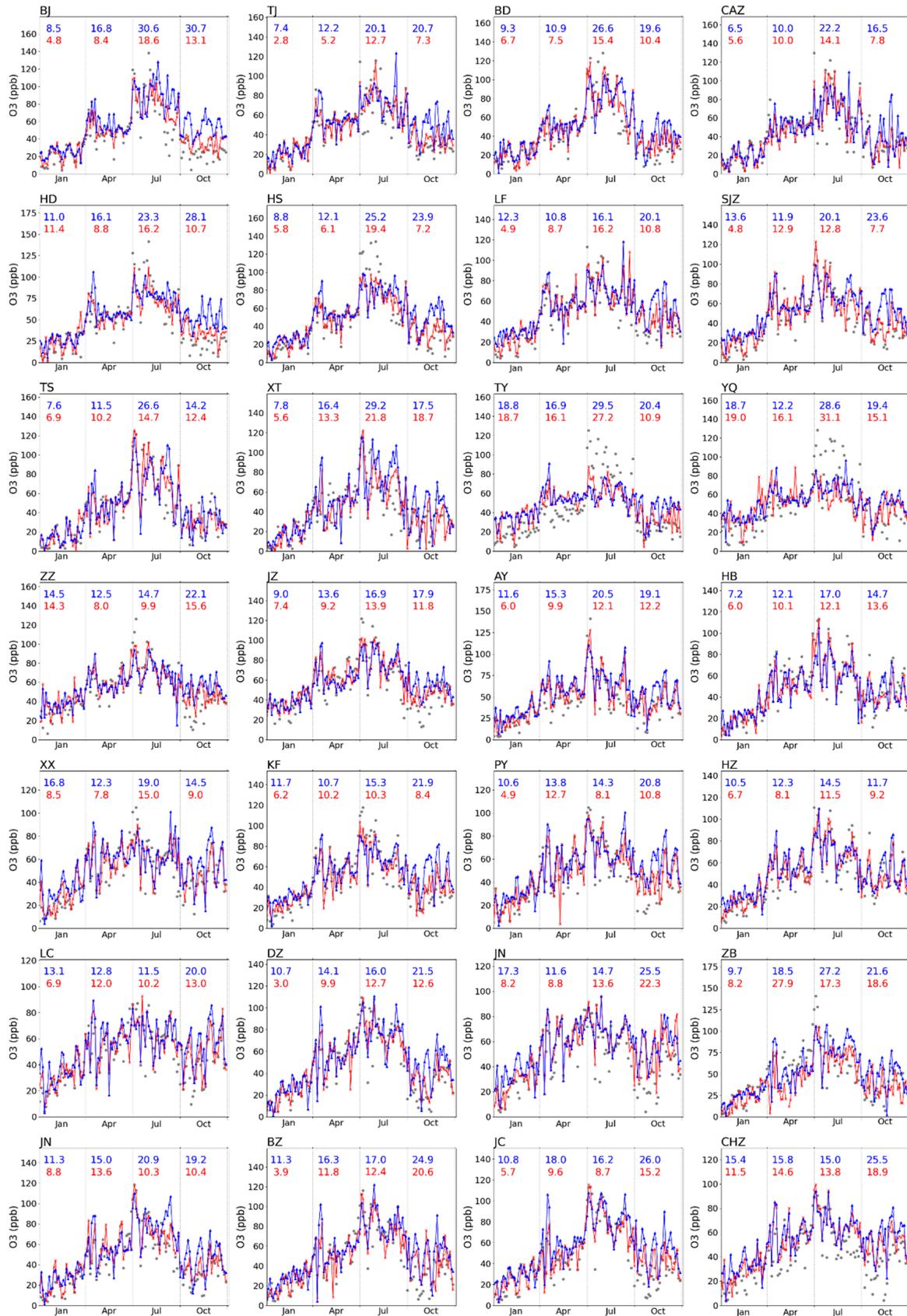
Figure S3. Comparison of observed (grey), CMAQ-simulated (blue) and RSM-assimilated (red) O_3 concentration (the numbers above represent RMSE in each month by cities).
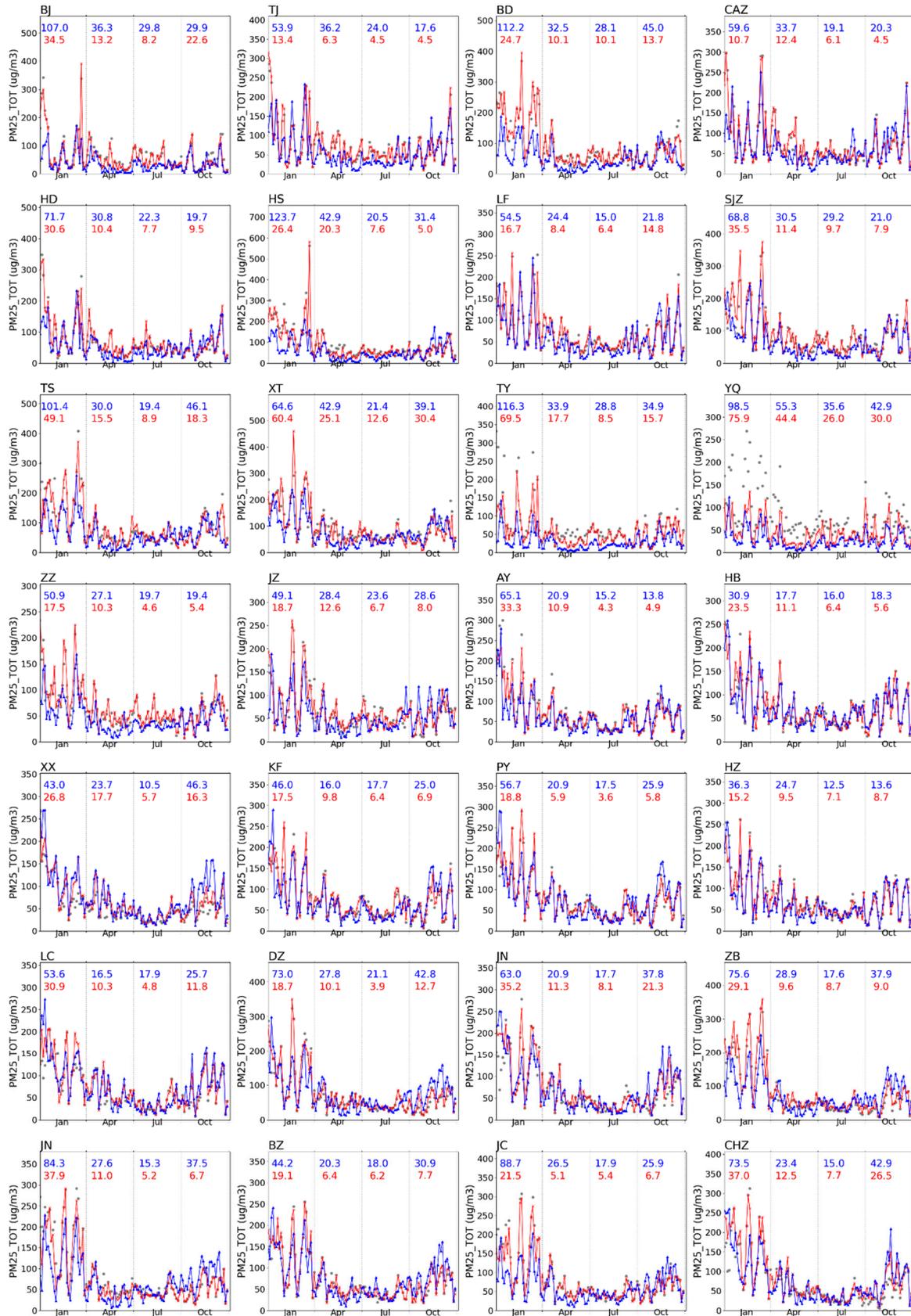
Figure S4. Comparison of observed (grey), CMAQ-simulated (blue) and RSM-assimilated (red) PM2.5 concentration (the numbers above represent RMSE in each month by cities)
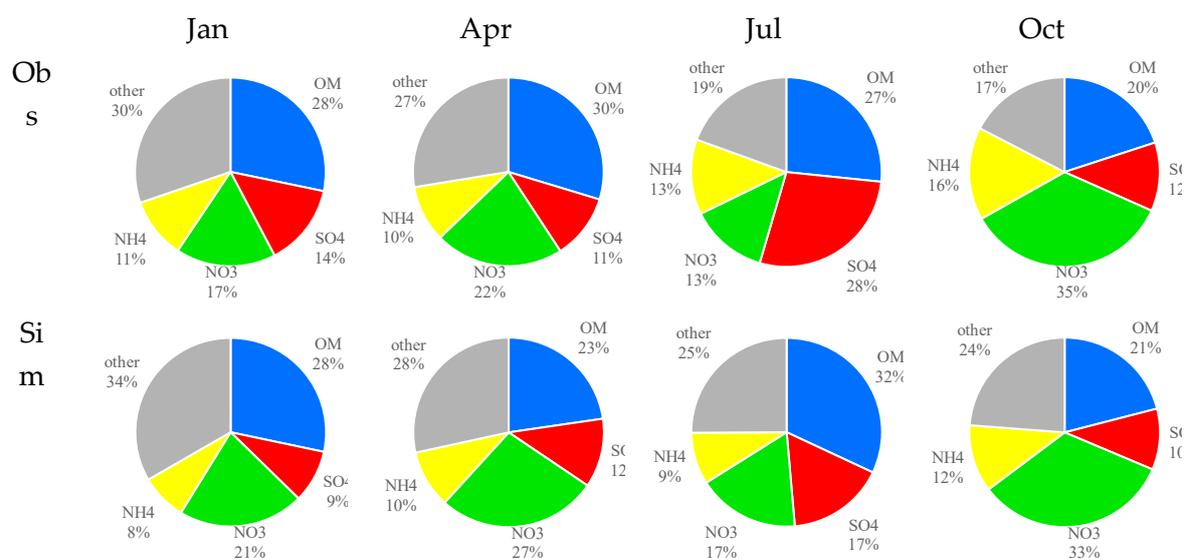
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Figure S5. Comparison of observed and simulated PM2.5 chemical component in a Beijing urban site (relative percentage in total PM2.5 mass concentration).