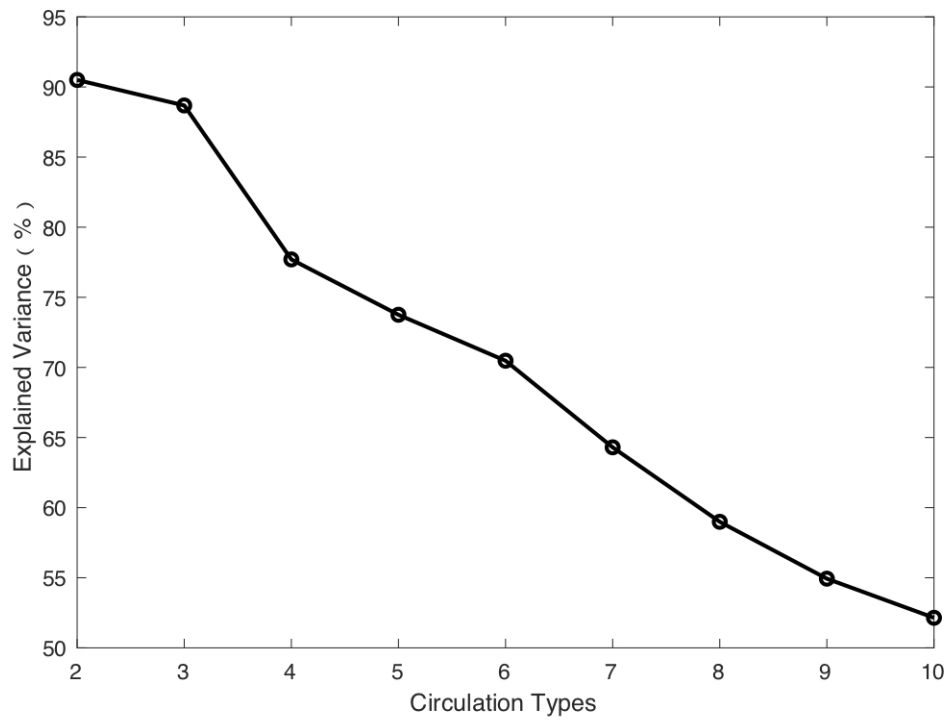
1 **Supplementary information for *Effects of atmospheric circulations***

2 ***on the interannual variation in PM$_{2.5}$ concentrations over the Beijing-***

3 ***Tianjin-Hebei region in 2013-2018***

6 Figure S1. Explained variance of circulation classification varies with the circulation types.

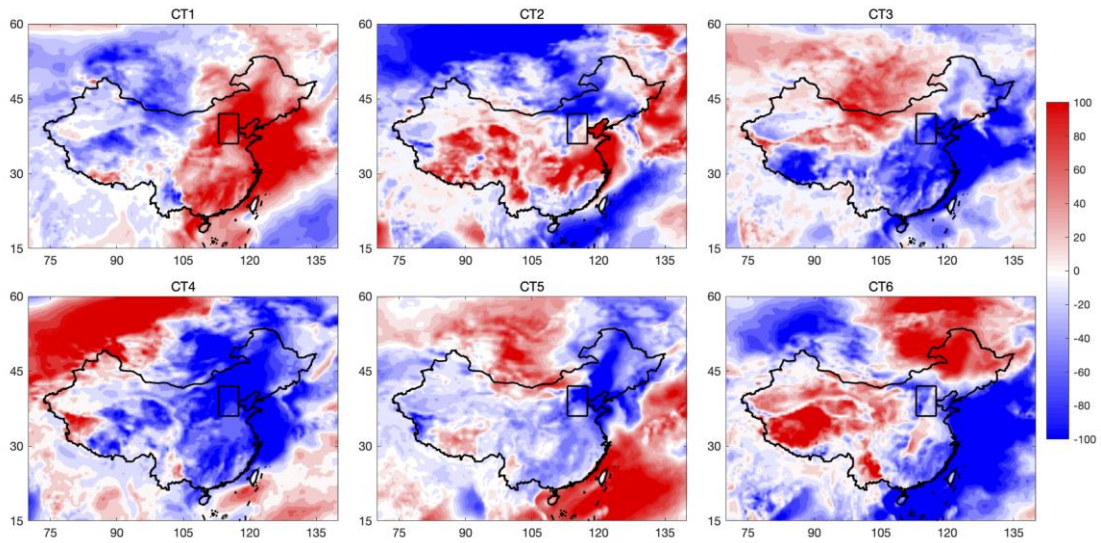



Figure S2. The distribution of boundary layer height (BLH) in each circulation type (unit: m). The anomaly values are with respect to the mean of 1980-2010.

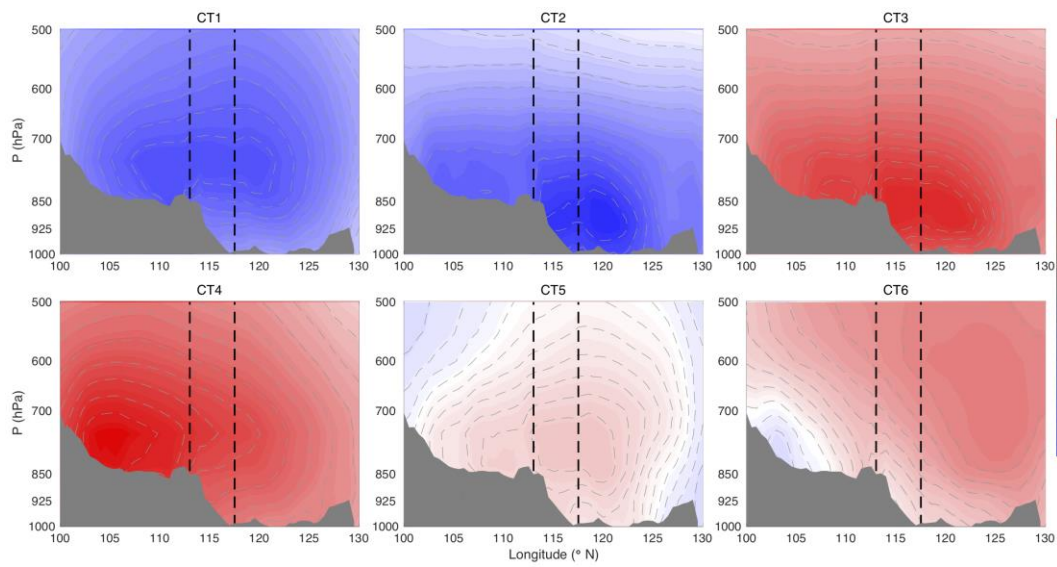
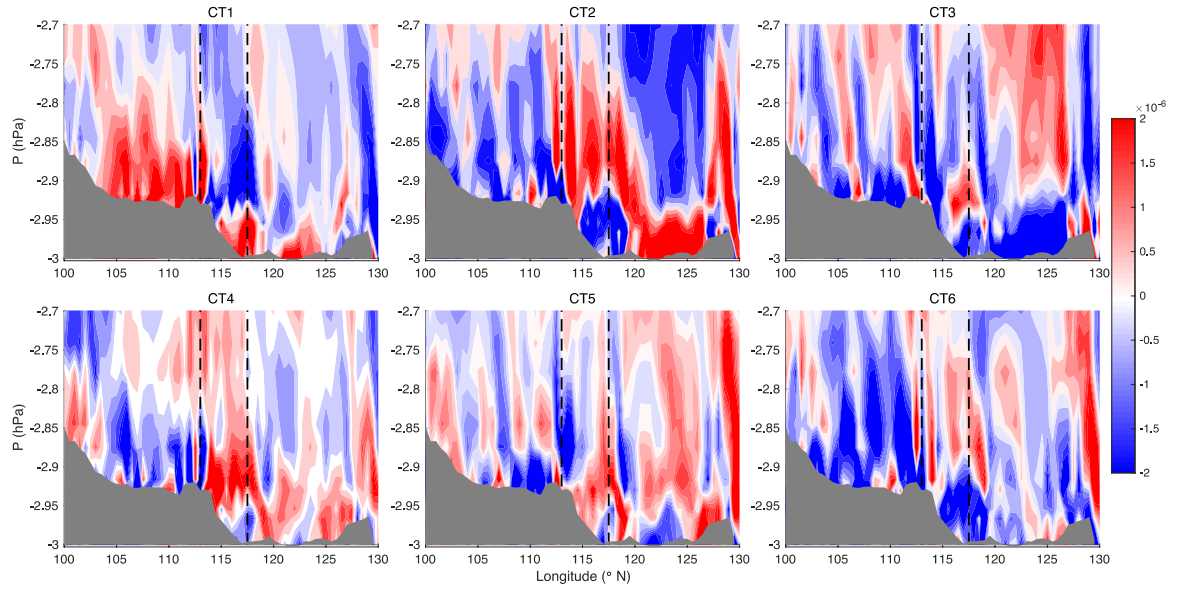



Figure S3. Zonal profile of temperature anomaly over BTH region (36º-42ºN) (unit: K). The grey region indicates the average altitude over 36º-42ºN. The region between two dashed line is the horizontal location of BTH (113º-117.5ºE).

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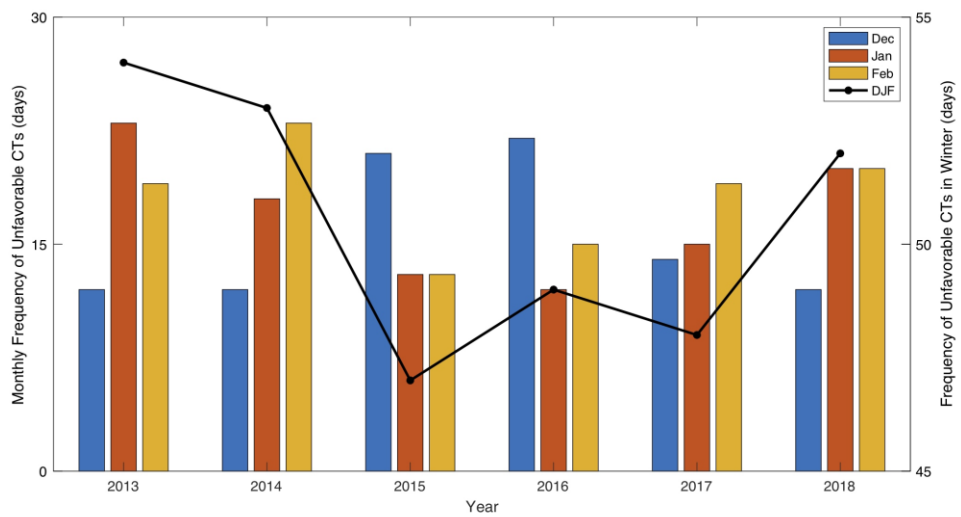
17   Figure S4. Zonal profile of divergence anomaly over BTH region (36º-42ºN) (unit: s⁻¹).

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19   Figure S5. Monthly and seasonal occurrence frequency of unfavorable circulation types (unit: days). The occurrence

20   of CT3 to CT6 are collectively called unfavorable CTs.

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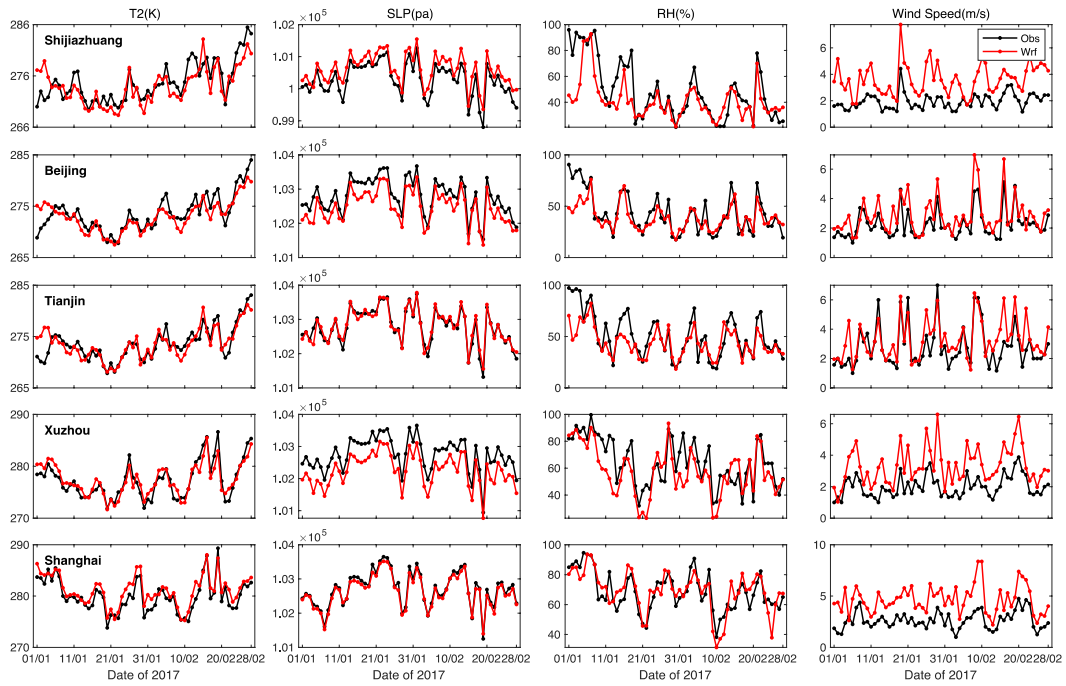
Figure S6. The observed and similated air temperature (T2), sea level pressure (SLP), relative humidity (RH) and 10 m wind speed (wind speed) over Shijiazhuang, Beijing, Tianjin, Xuzhou and Shanghai durig Jan. to Feb. of 2017. The meteorological variables come from the Intergrated Surface Database of National Climate Data Center (https://www.ncdc.noaa.gov/isd).

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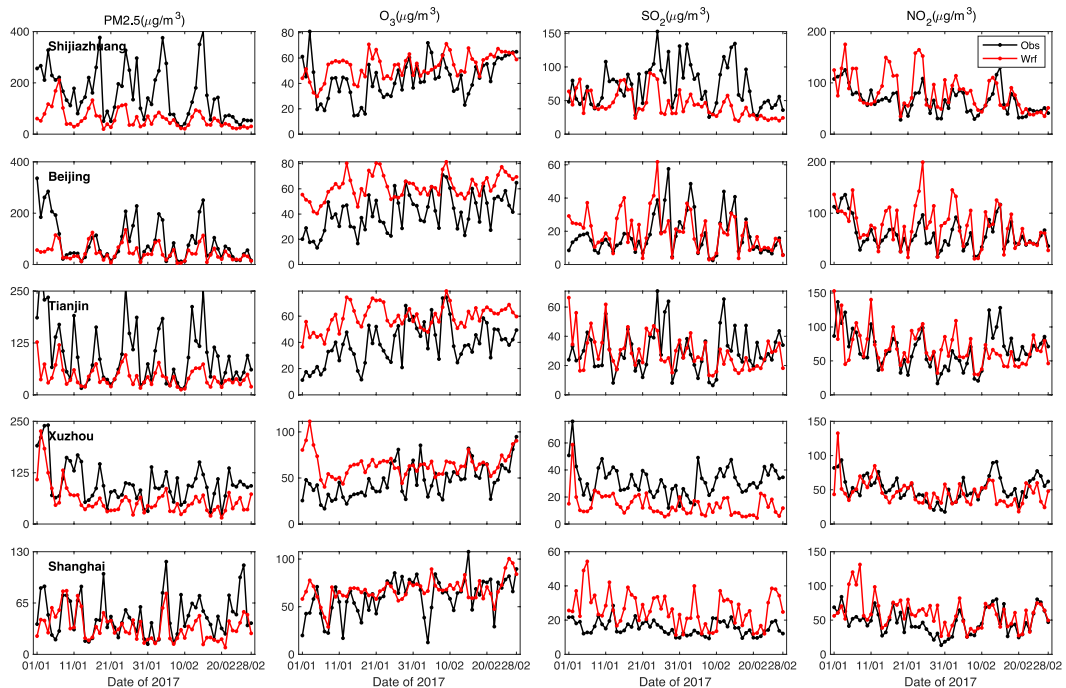
Figure S7. The observed and similated PM$_{2.5}$, O$_3$, SO$_2$, NO$_2$ concentrations over Shijiazhuang, Beijing, Tianjin, Xuzhou and Shanghai during Jan. to Feb. of 2017.

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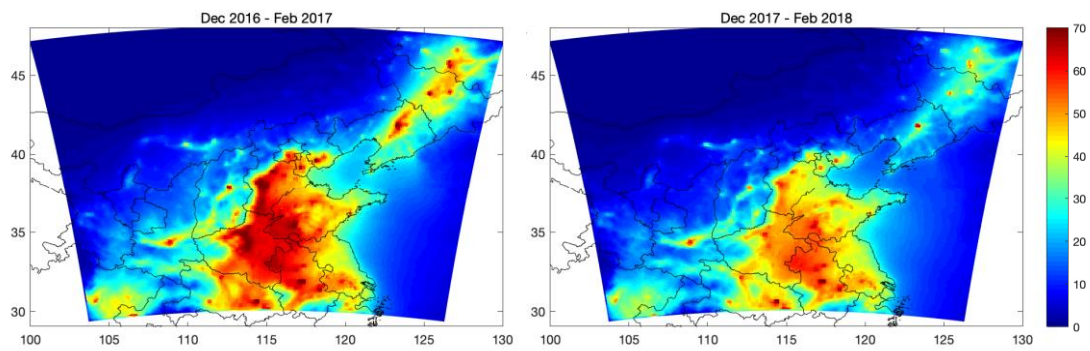
Figure S8. The simulated seasonal mean PM$_{2.5}$ concentrations during the winters of 2016 and 2017 (unit: μg/m^3).

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