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Supplement of

Dominant synoptic patterns associated with the decay process of PM_{2.5} pollution episodes around Beijing

Xiaoyan Wang et al.

Correspondence to: Xiaoyan Wang (wangxyfd@fudan.edu.cn)

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● **Lamb-Jenkinson method for the objective circulation classification**

ERA5 daily mean sea level pressure in Jan. 2014 to Mar. 2020 are used to classify the synoptic circulation types based on Lamb-Jenkinson method. Circulation types are classified into 26 types including eight directional types (northerly, N; northeasterly, NE; easterly, E; southeasterly, SE; southerly, S; southwesterly, SW; westerly, W; and northwesterly, NW), two vorticity types (cyclonic, C; anticyclonic, A) and sixteen hybrid types (CN, CNE, CE, CSE, CS, CSW, CNW, AN, ANE, AE, ASE, AS, ASW, AW and ANW). Figure S2 shows the seasonal frequency of the 26 CTs during Jan. 2014 to Mar. 2020. The frequencies of the two vorticity and eight directional types were much higher than those of other sixteen hybrid CTs. The top four highest frequency for the specific season are highlighted in Fig. S2. Fig. S3 shows the distribution of atmospheric circulation at 925 hPa of the top four highest frequency CTs. Circulation characteristics in Figure S1 has the similar pattern with those in Figure S3, which indicates the robust of the two circulation classification methods.

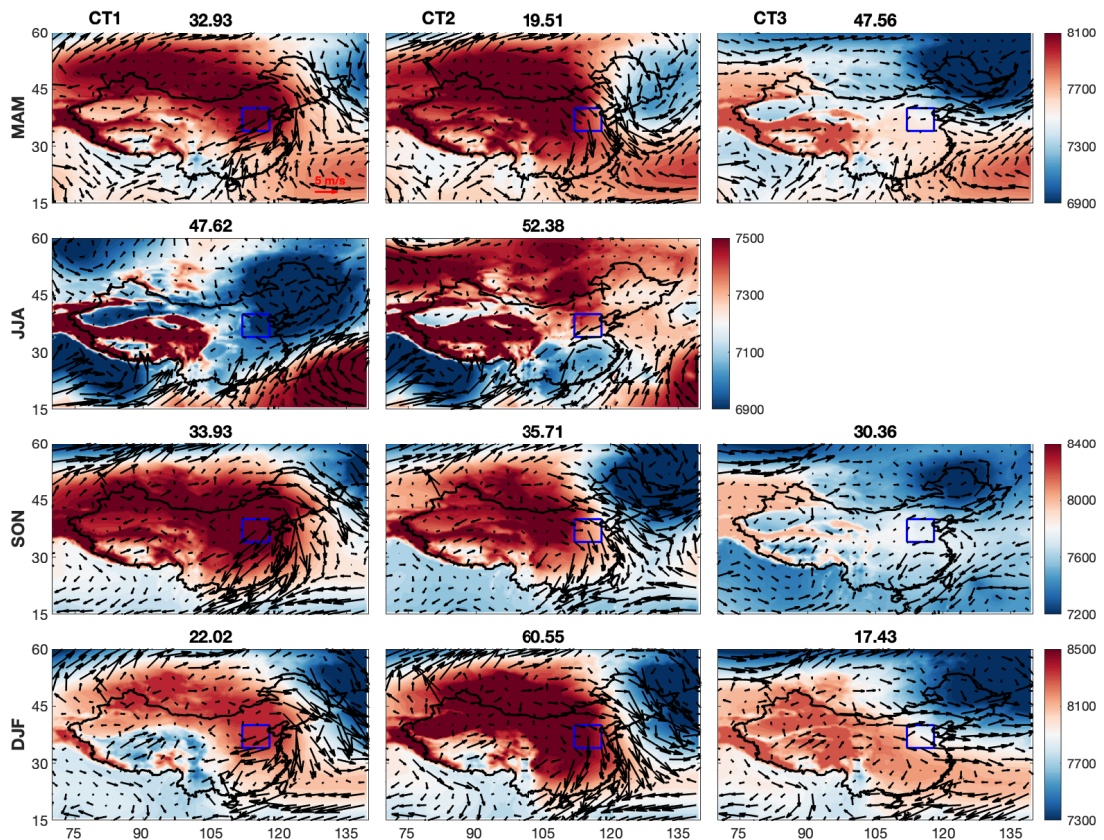


Figure S1. Distribution of the geopotential height (shaded, units: m^2/s^2) and wind fields at 925 hPa for each circulation type based on PCA method. The number over each subplot indicates the occurrence frequency of the specific circulation type. The solid blue box is the location of the domain region covering the 28 pollution channel cities.

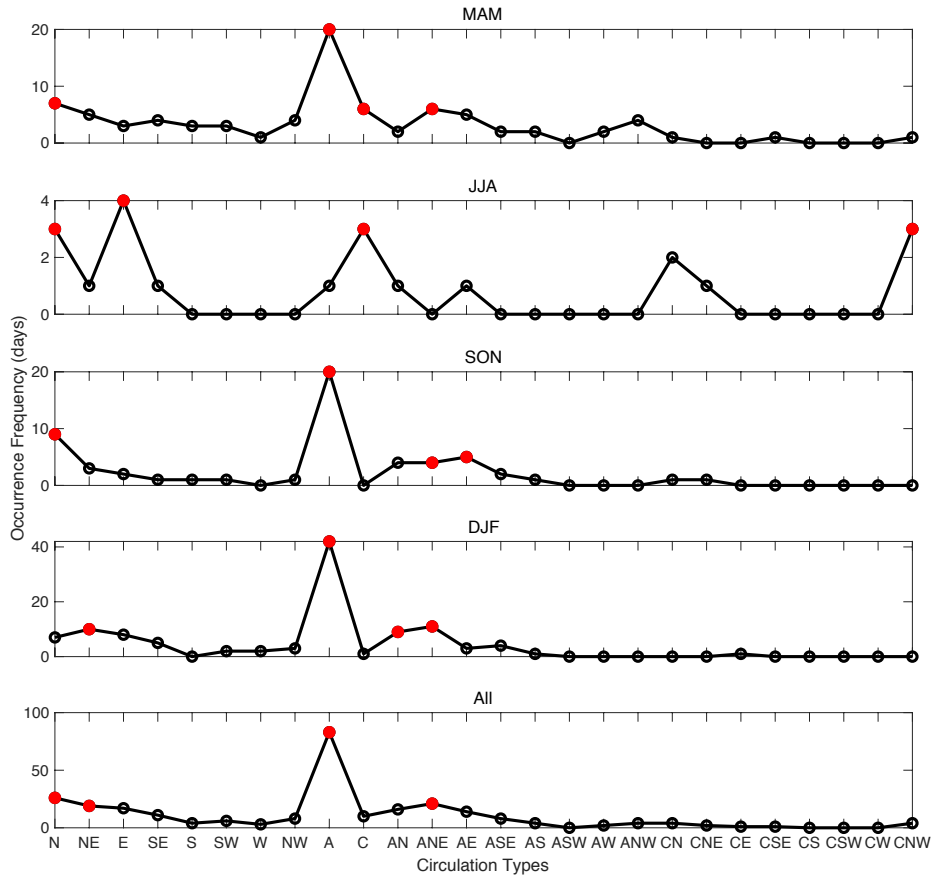


Figure S2. Occurrence frequency of 26 kinds of circulation types based on Lamb-Jenkinson circulation classification method during Jan. 2014 to Mar. 2020. Red dots indicate the top four highest frequency.

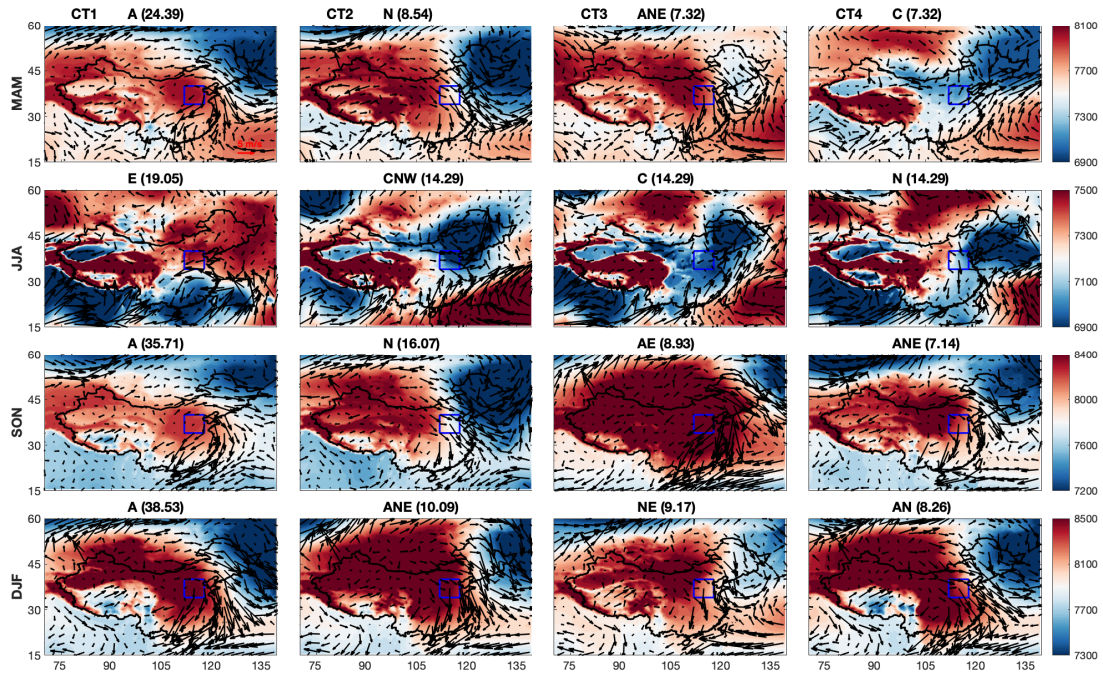


Figure S3. Distribution of the geopotential height (shade, units: m^2/s^2) and wind fields at 925 hPa for the top four highest frequency CTs based on Lamb-Jenkinson classification methods. The title of each subplot indicates the specific CTs and the corresponding frequency (%) in each season.

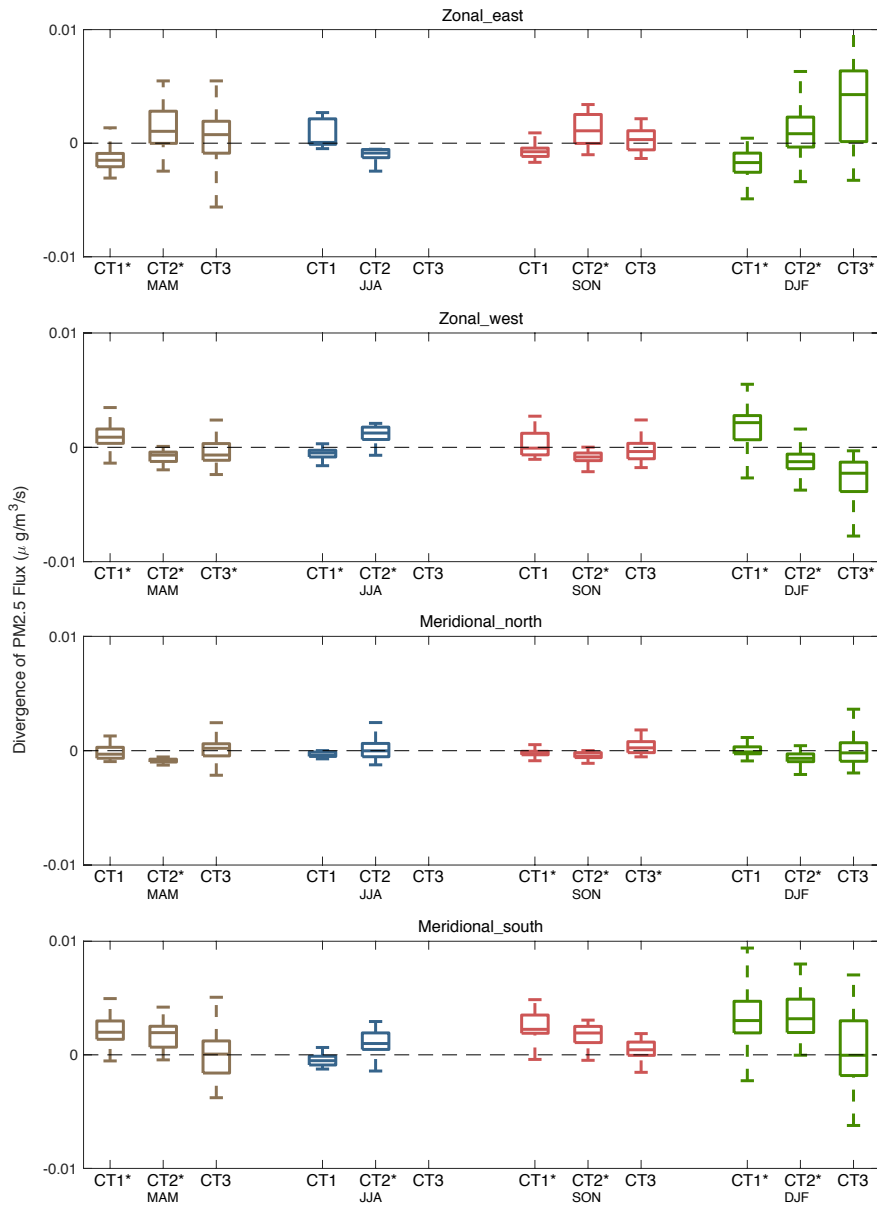


Figure S4. Boxplot of the divergence of PM2.5 flux from the four sides of the region of 34-40° N and 112-118° E. Positive divergence indicates outflow of PM2.5 from the specific direction; negative divergence indicates inflow of PM2.5 from the domain. * in the x axis marks the divergence in a specific CT is significantly different with zero based on two-tail student-t test at a significant level of 0.01.

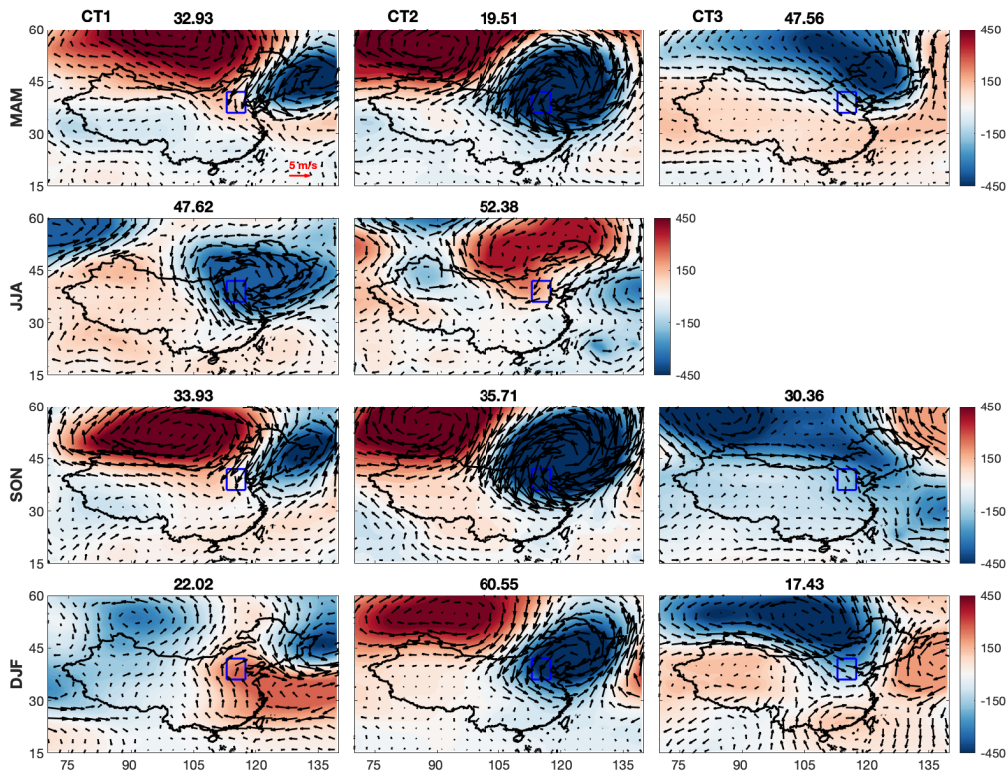


Figure S5. Distribution of the geopotential height anomalies (shaded, unit: m^2/s^2) and wind field anomalies at 500 hPa for each circulation type. The number over each subplot indicates the occurrence frequency of the specific circulation type. The solid blue box is the location of the domain region covering the 28 pollution channel cities.

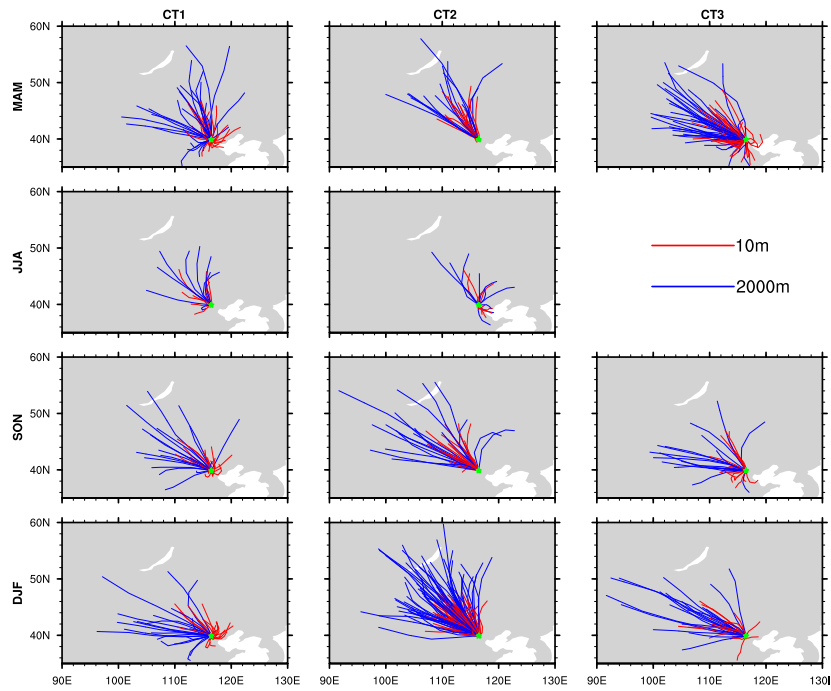


Figure S6. 24 h backward trajectories of Beijing at 10 m and 2000 m (above ground level) on all the decay phase days based on the NOAA HYSPLIT Trajectory model.