Supplementary Materials

Impact of Weather Patterns and Meteorological Factors on PM$_{2.5}$ and O$_3$ during the Covid-19 Lockdown in China

Fuzhen Shen[1], Michaela I. Hegglin[1,2*], Yue Yuan[3]

[1]Institute of Energy and Climate Research, IEK-7: Stratosphere, Forschungszentrum Jülich, 52425 Jülich, Germany
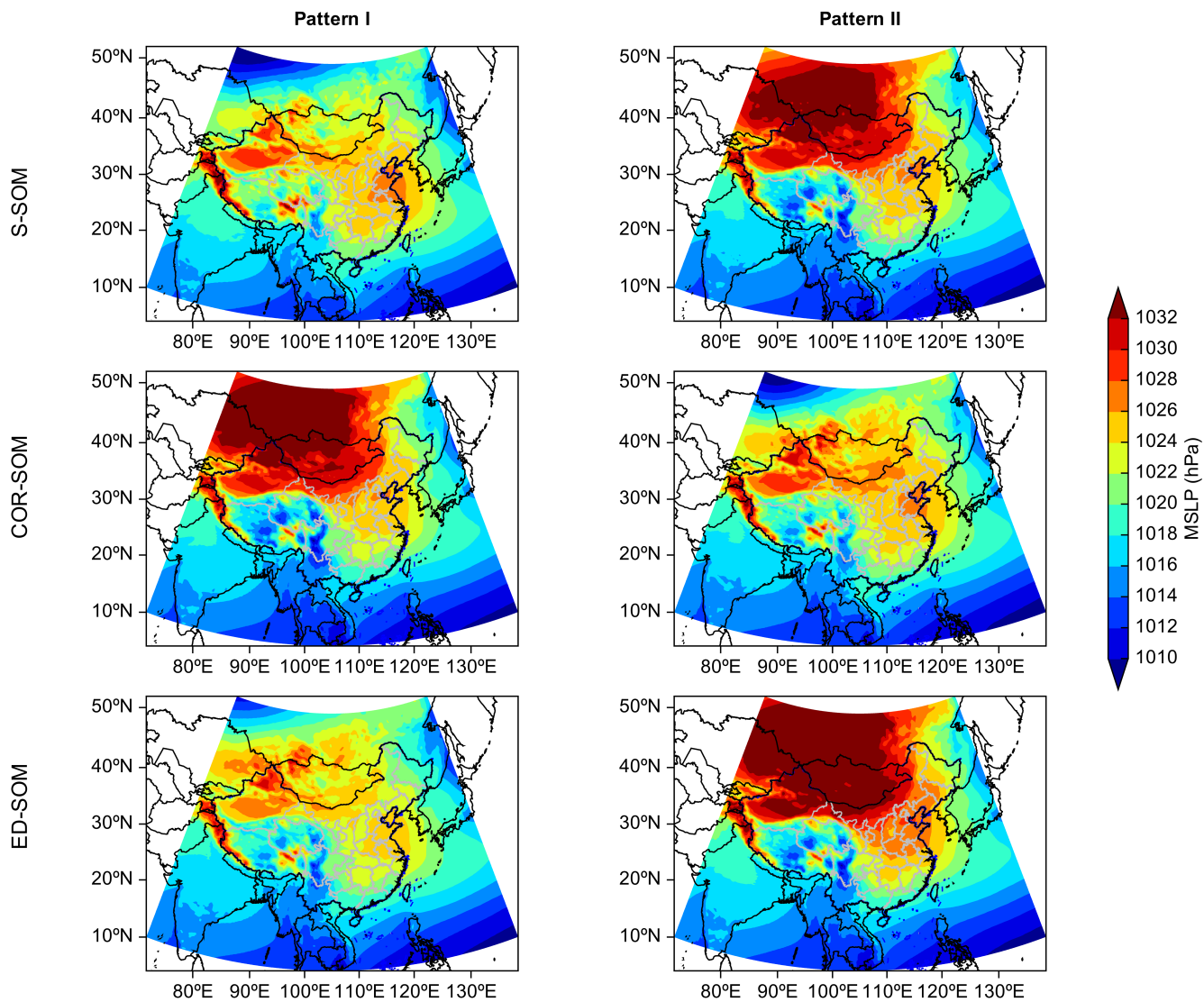
[2]Department of Meteorology, University of Reading, Reading, RG6 6BX, UK

[3]Jining Meteorological Bureau, Shandong 272000, China

Correspondence to: Fuzhen Shen (f.shen@fz-juelich.de); Michaela I. Hegglin (m.i.hegglin@fz-juelich.de)

This file includes: Supplementary Figures 1 to 24

Figure S1: Spatial distributions of two weather patterns for MSLP (Mean Sea Level Pressure) identified by S-SOM, COR-SOM, and ED-SOM over 2015-2020, respectively.
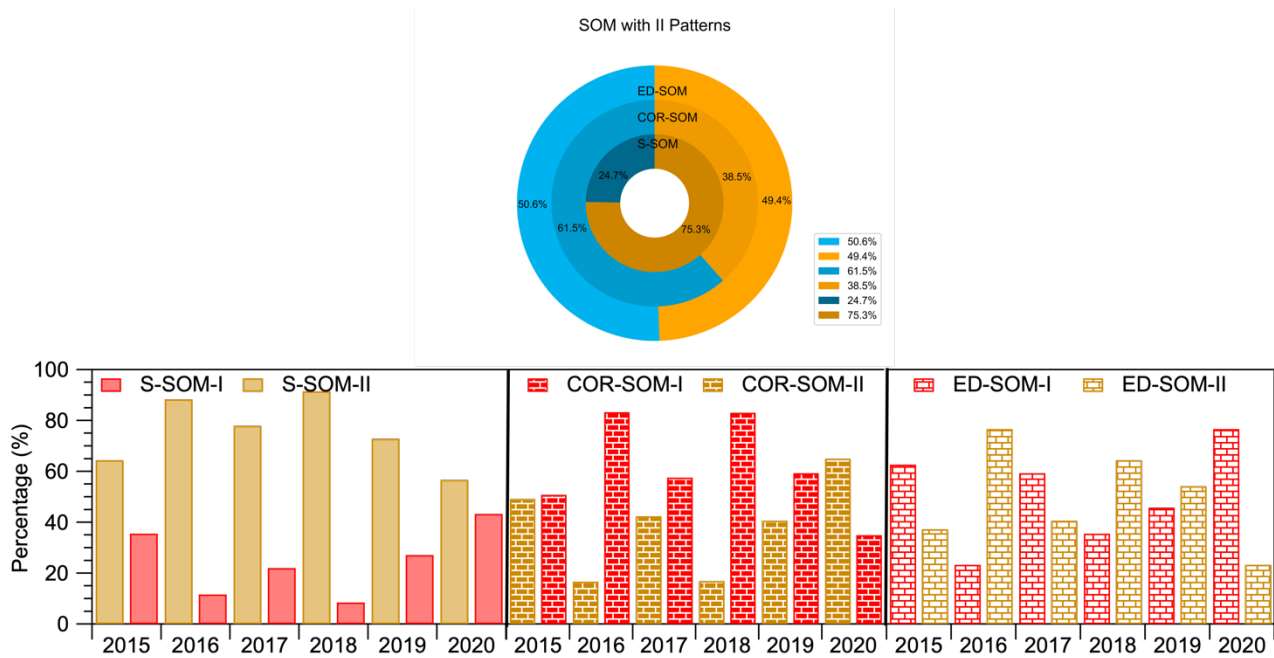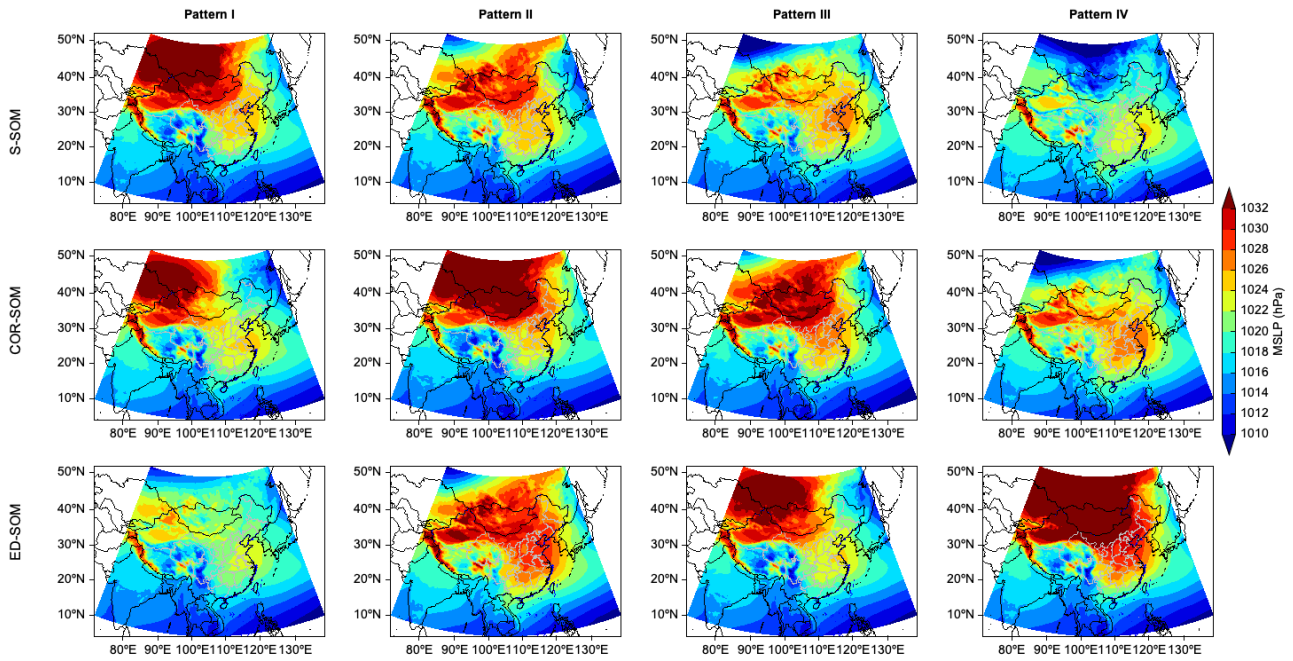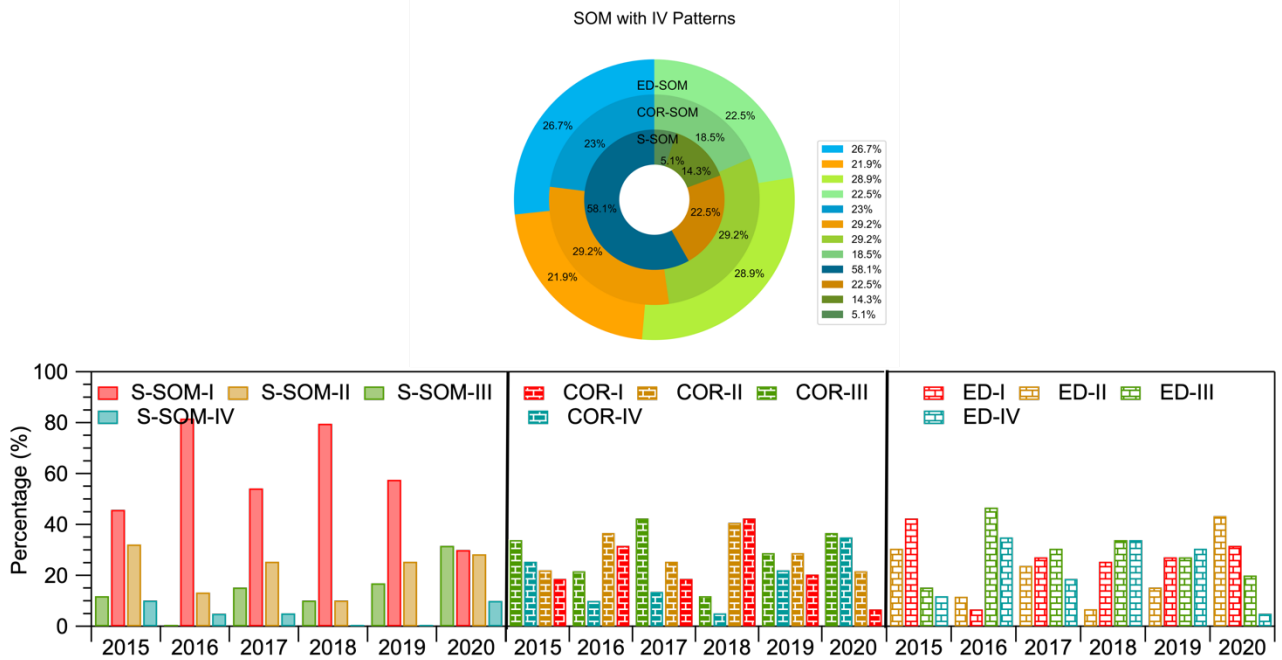
Figure S2: Cluster size distributions of two weather patterns identified by S-SOM (inner ring), COR-SOM (middle ring) and ED-SOM (outer ring) over the years of 2015-2020 and days in each year (bar plot).

20

Figure S3: Spatial distributions of four weather patterns for MSLP (Mean Sea Level Pressure) identified by S-SOM, COR-SOM, and ED-SOM over 2015-2020, respectively.

Figure S4: Cluster size distributions of four weather patterns identified by S-SOM (inner ring), COR-SOM (middle ring) and ED-SOM (outer ring) over the years of 2015-2020 and days in each year (bar plot).
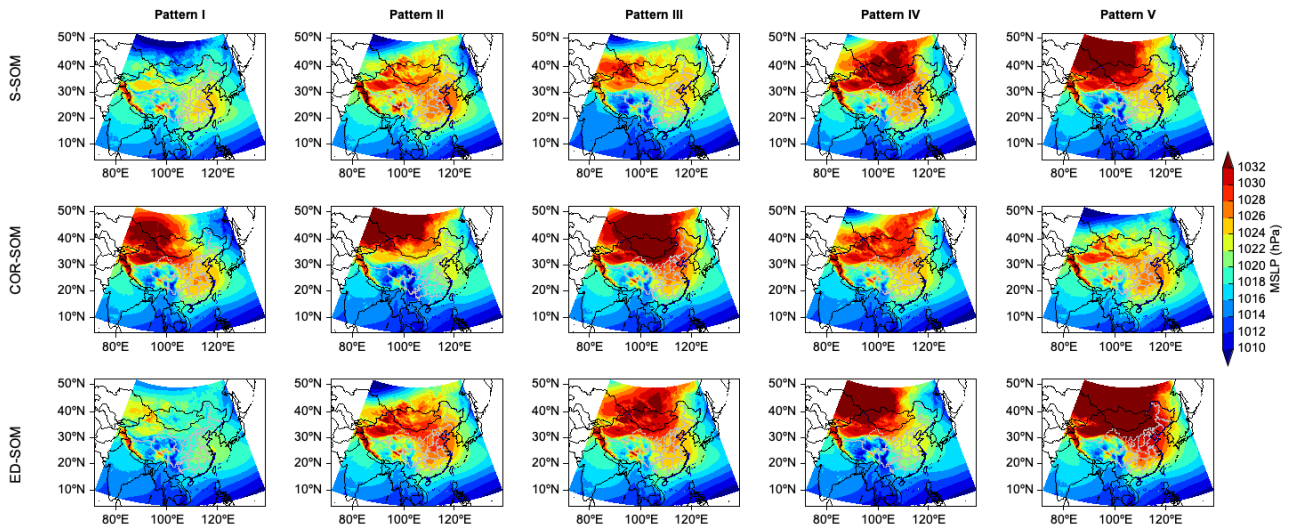
Figure S5: Spatial distributions of five weather patterns for MSLP (Mean Sea Level Pressure) identified by S-SOM, COR-SOM, and ED-SOM over 2015-2020, respectively.
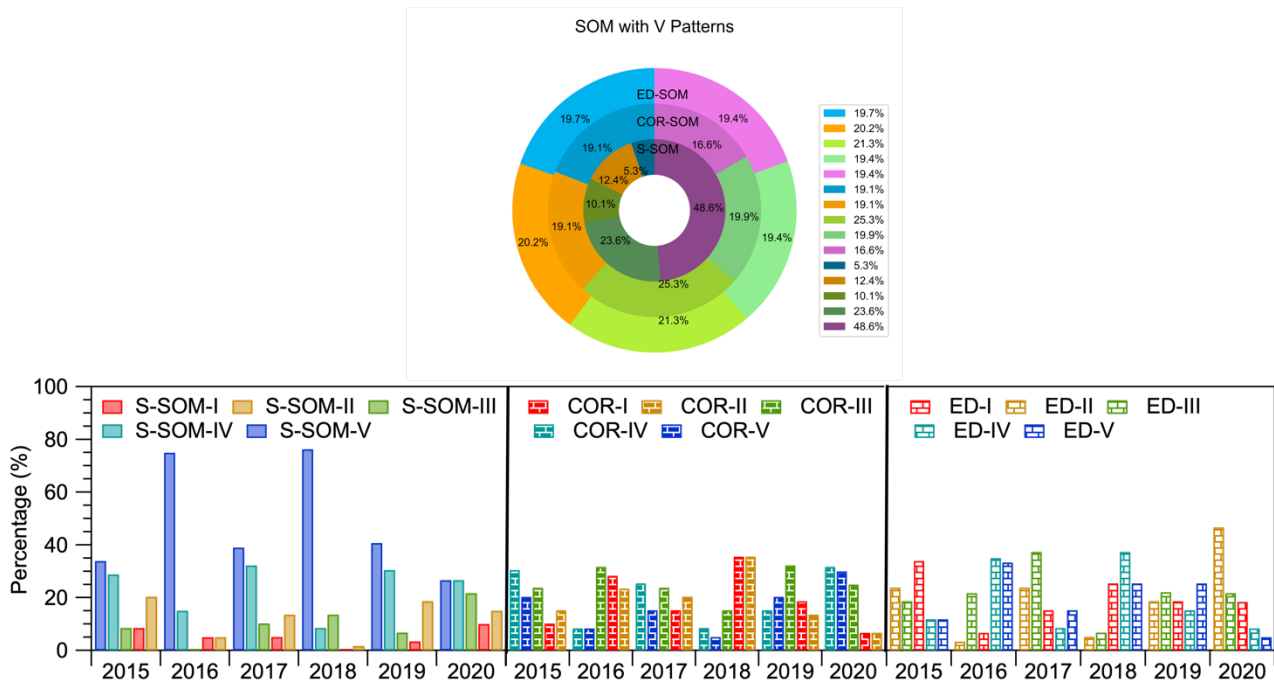
Figure S6: Cluster size distributions of five weather patterns identified by S-SOM (inner ring), COR-SOM (middle ring) and ED-SOM (outer ring) over the years of 2015-2020 and days in each year (bar plot).

35

Figure S7: Spatial distributions of six weather patterns for MSLP (Mean Sea Level Pressure) identified by S-SOM, COR-SOM, and ED-SOM over 2015-2020, respectively.
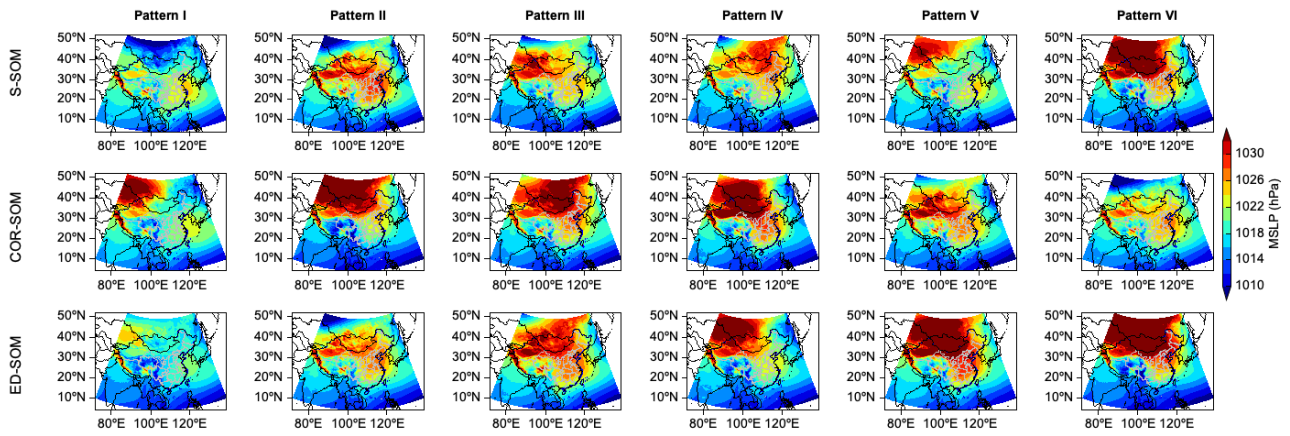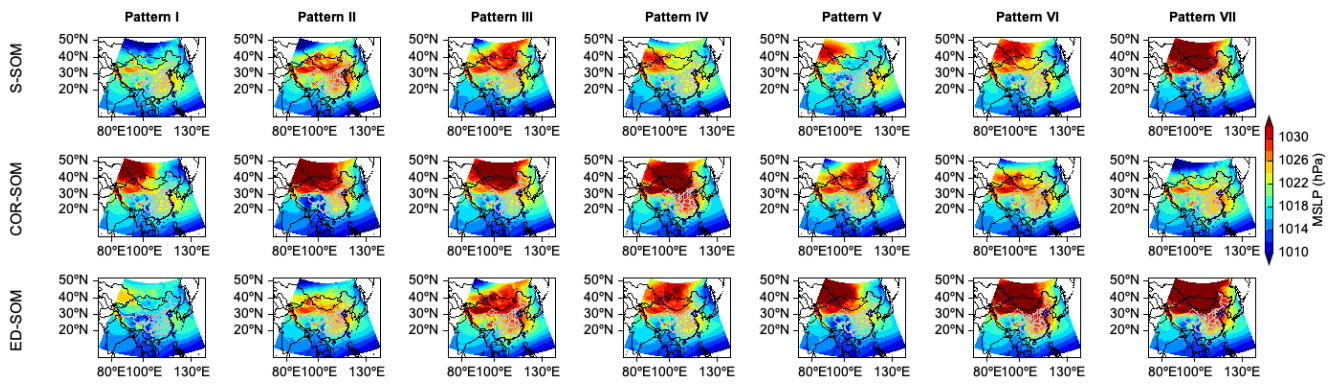
40

Figure S8: Cluster size distributions of six weather patterns identified by S-SOM (inner ring), COR-SOM (middle ring) and ED-SOM (outer ring) over the years of 2015-2020 and days in each year (bar plot).

Figure S9: Spatial distributions of seven weather patterns for MSLP (Mean Sea Level Pressure) identified by S-SOM, COR-SOM, and ED-SOM over 2015-2020, respectively.

Figure S10: Cluster size distributions of seven weather patterns identified by S-SOM (inner ring), COR-SOM (middle ring) and ED-SOM (outer ring) over the years of 2015-2020 and days in each year (bar plot).
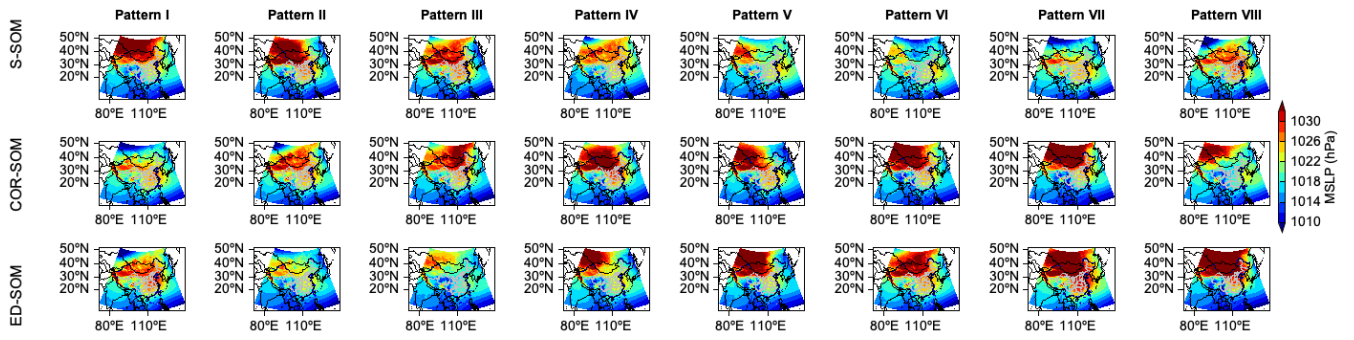
Figure S11: Spatial distributions of eight weather patterns for MSLP (Mean Sea Level Pressure) identified by S-SOM, COR-SOM, and ED-SOM over 2015-2020, respectively.
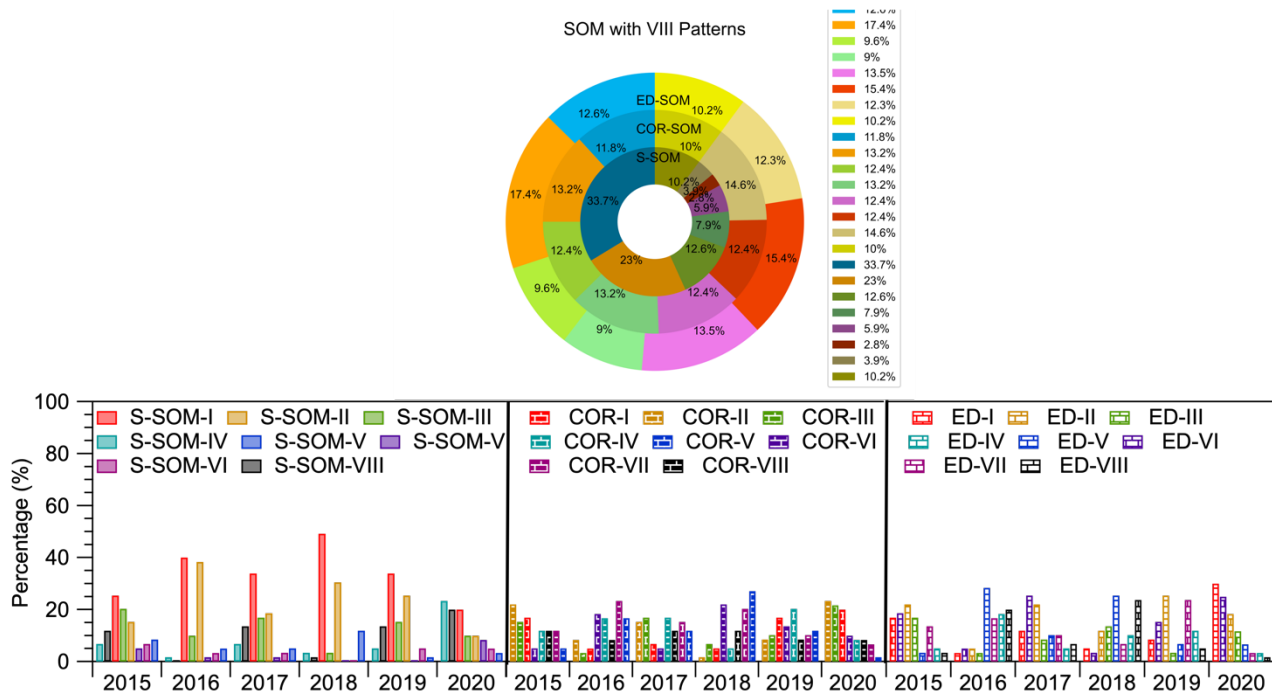
Figure S12: Cluster size distributions of eight weather patterns identified by S-SOM (inner ring), COR-SOM (middle ring) and ED-SOM (outer ring) over the years of 2015-2020 and days in each year (bar plot).
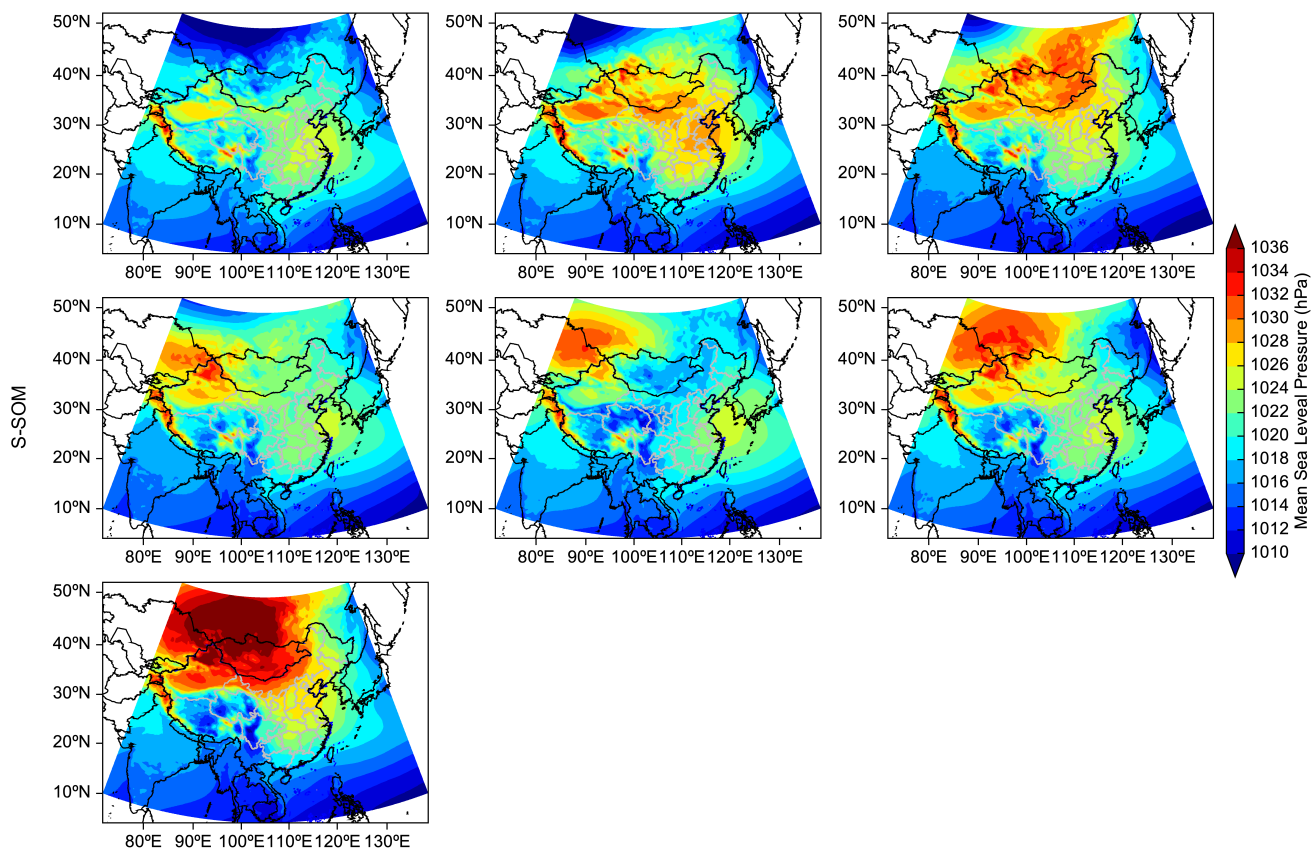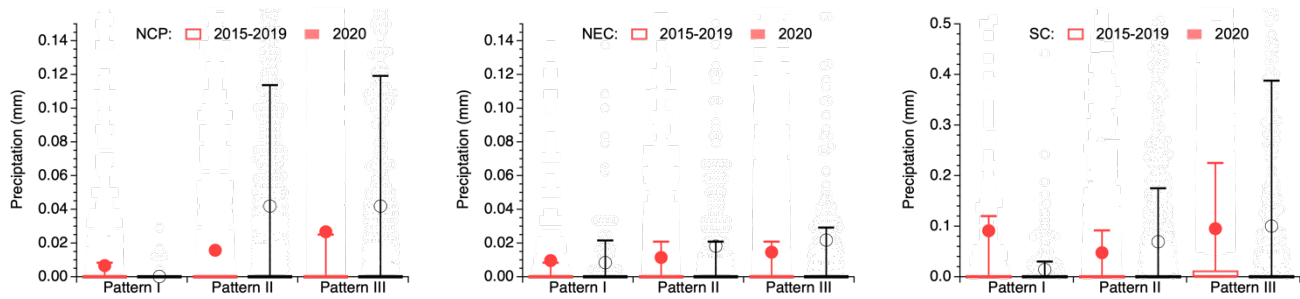
60

Figure S13: Spatial distributions of seven weather patterns for MSLP (Mean Sea Level Pressure) identified over 2015-2020.

65 **Figure S14: Comparisons of Precipitation between days in 2020 (red rings and solid whisker-box)and in 2015-2019 (black rings and hollow whisker-box) in three weather patterns in NCP, NEC, and SC respectively.**

Figure S15: The calendar occurrences of three weather patterns over 2015-2020 (Note that haze event occurred from 21st January to 9th February 2020).
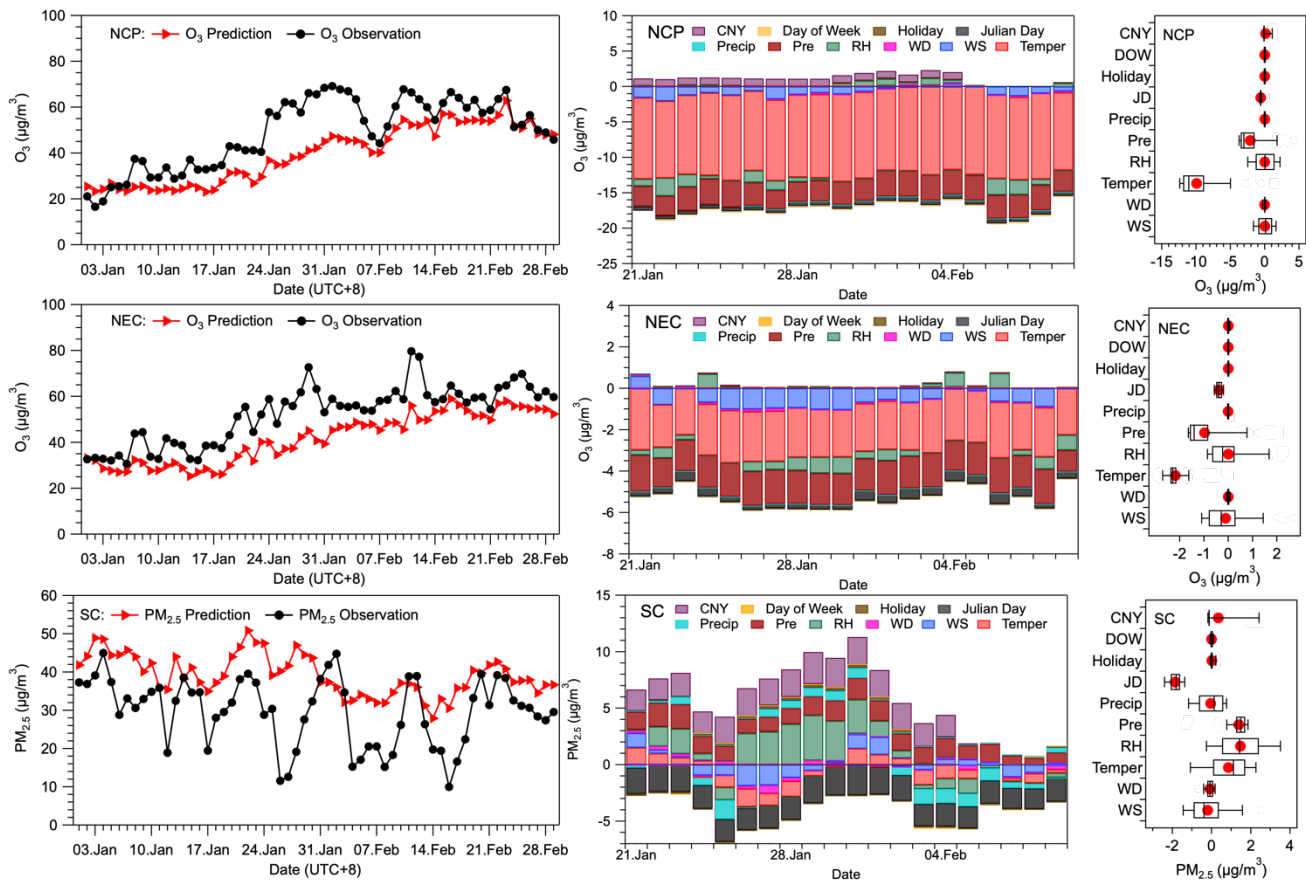
Figure 16: Time series comparisons between observations (black dot line) and predictions (red triangle line) combined with the contributions from the input variables (colourful bar) to the O_3 and $PM_{2.5}$ change in NCP, NEC, and SC respectively. Note that the whisker-box plots represent the mean importance of the input variables during the prediction in NCP, NEC, and respectively.