1		Supplementary Materials for
2	Synoptic drivers of co-occurring summertime ozone and PM2.5 pollution in	
3		eastern China
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## Determining the number of synoptic patterns

21 The explained cluster variance (ECV) ranging from 0 to 1 is selected to assess the performance of

22 synoptic classification and to determine the number of classes (Hoffmann & SchlüNzen, 2013;

23 Philipp et al., 2014). ECV is defined as:

$$ECV = 1 - \frac{WS}{TS}$$
(1)

25 Where *WS* is the sum of squares within synoptic patterns, and *TS* is the total of sum of squares:

26 
$$WS = \sum_{j=1}^{k} \sum_{i \in C_j} D^2_{(Y_i, \overline{Y_j})}$$
(2)

27 
$$TS = \sum_{i=1}^{n} \sum_{l=1}^{m} (Y_{il}, \overline{Y_l})^2$$
(3)

28 where *k* is synoptic patterns number,  $C_j$  is the pattern *j*, and the squared Euclidean distance  $D^2_{(Y_i, \overline{Y_j})}$ 

## 29 between an element and its centroid is defined as:

30 
$$D^{2}_{(Y_{i},\overline{Y_{j}})} = \sum_{l=1}^{m} (Y_{il},\overline{Y_{jl}})^{2}$$
(4)

31 where *l* is the time step (*l*=1, 2, ..., m),  $Y_{il}$  is the respective data point,  $\overline{Y_{jl}}$  is the estimate of the 32 mean value for synoptic pattern *j*,  $\overline{Y_l}$  is the estimate of the total mean.

Then, the synoptic patterns number k can be determined by the increment of the *ECV* value (Ning et al., 2019):

35

$$\Delta ECV = ECV_k - ECV_{k-1} \tag{5}$$

The number of synoptic patterns k is finally determined when the  $\triangle ECV$  reaches the highest value, which suggests that the classification performance is improved substantially and tends to be stable (Ning et al., 2019).





Fig. S1. Changes of *AECV* with different numbers of classified synoptic patterns.









Fig. S3. Average concentration of PM<sub>2.5</sub> under four SWPs.







55 Fig. S6. The number and probability of occurrence of compound pollution days in each site.

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