

1 *Supplement of*

2 **An underappreciated cyclonic-like circulation drives high summer ozone in North China Plain**

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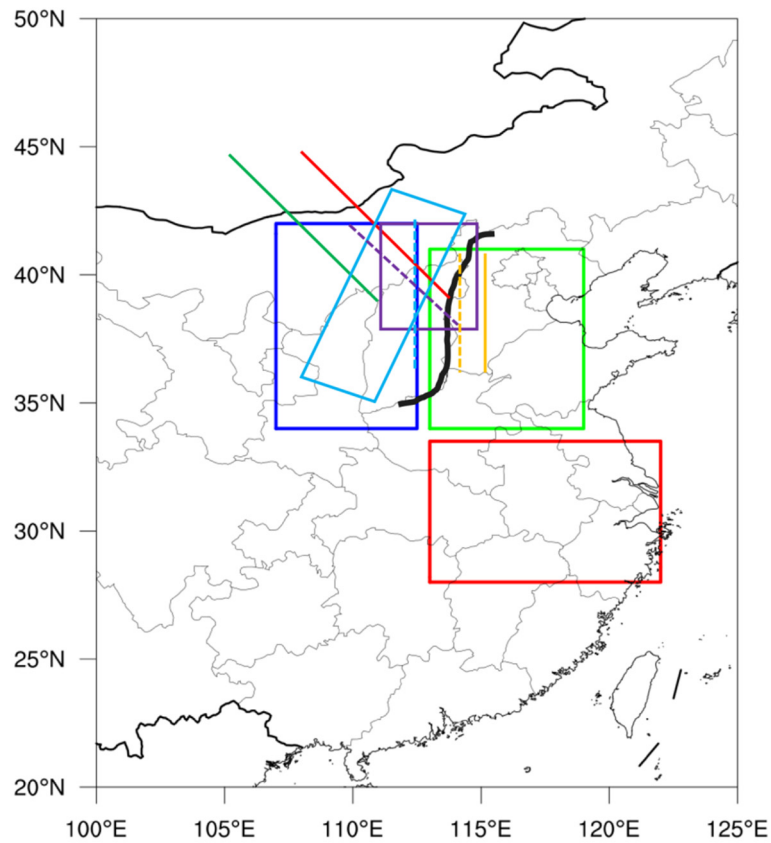
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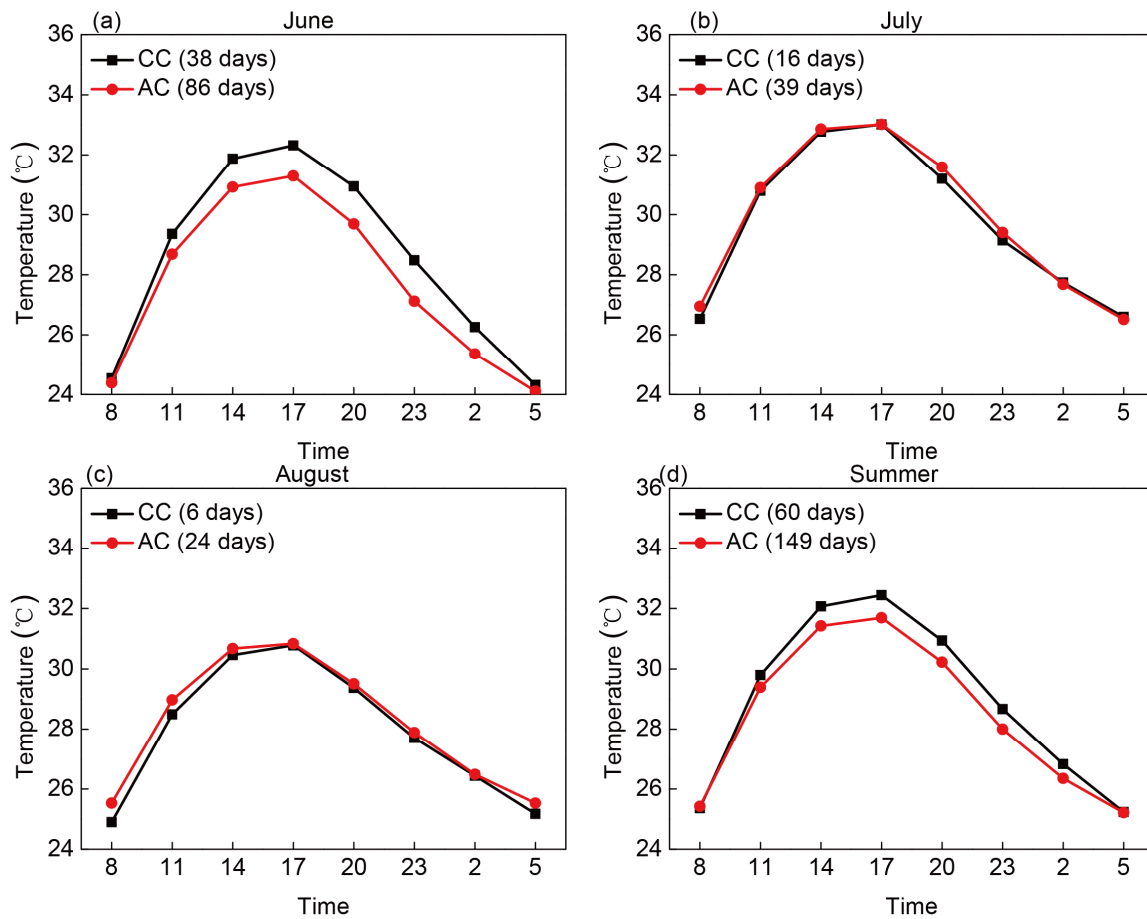
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15 Figures S1 to S8



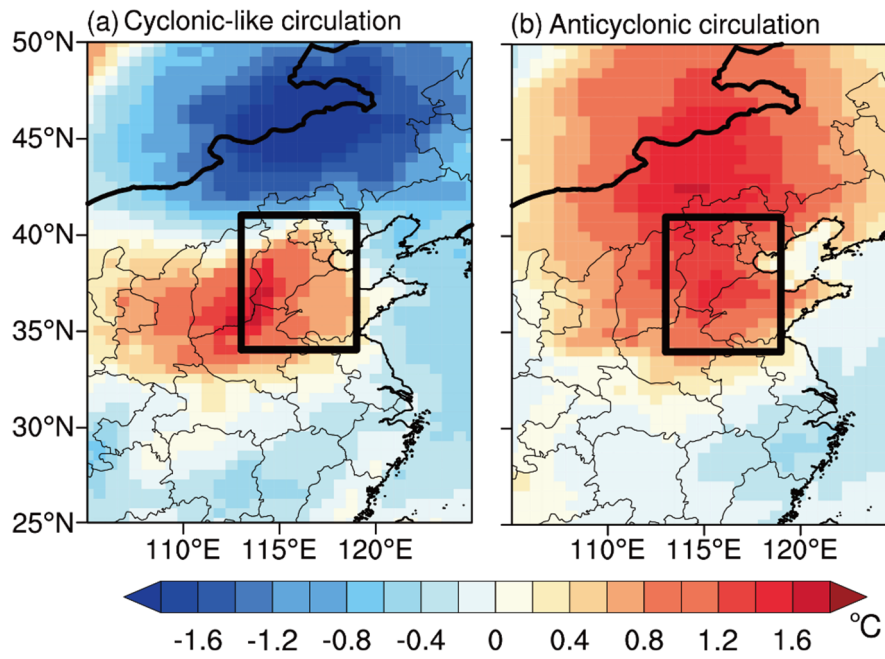
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17 **Figure S1.** Geographic domains of the NCP, NW, SE regions, and the locations of transects used to
 18 identify northwesterly flow associated with cyclonic-like circulation. Green, blue, and red rectangles
 19 denote the NCP (34°–41°N, 113°–119°E), NW (34°–42°N, 107°–112.5°E), and SE (28°–33.5°N,
 20 113°–122°E) regions, respectively. The green solid line represents the transect adopted by Chen and
 21 Lu (2016). The red solid line, purple boxed line, purple dashed line, blue boxed line, blue dashed line,
 22 yellow solid line, and yellow dashed line denote transect_1 through transect_7, respectively. Transect
 23 3 achieves the highest accuracy in detecting cyclonic-like circulation and is therefore used in this
 24 study to identify northwesterly flow associated with cyclonic-like circulation.



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26 **Figure S2.** Diurnal temperature variations at stations (37°N, 115°E) in the western NCP under
 27 cyclonic-like circulation (black line) and anticyclonic circulation (red line) in (a) June, (b) July, (c)
 28 August, and the (d) summer mean during 2017-2022.

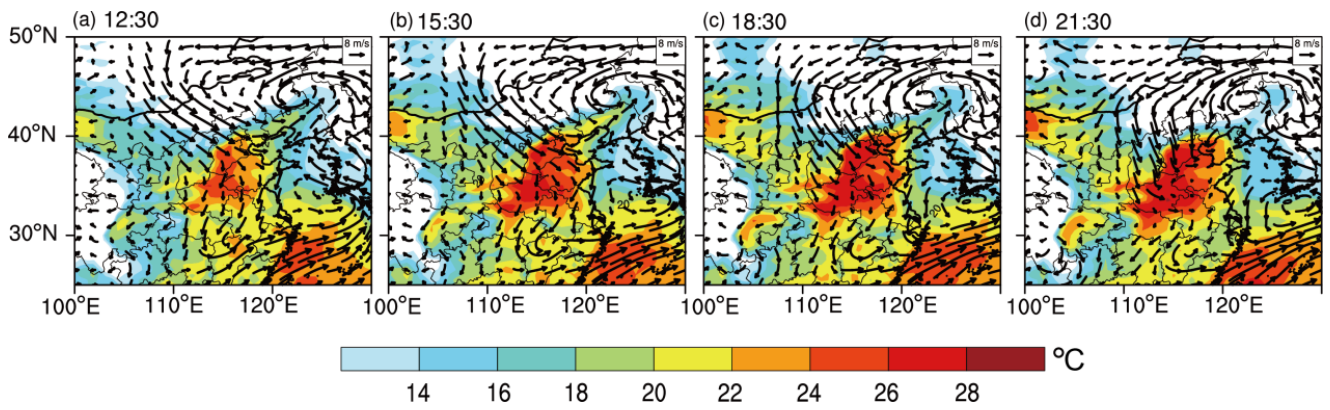


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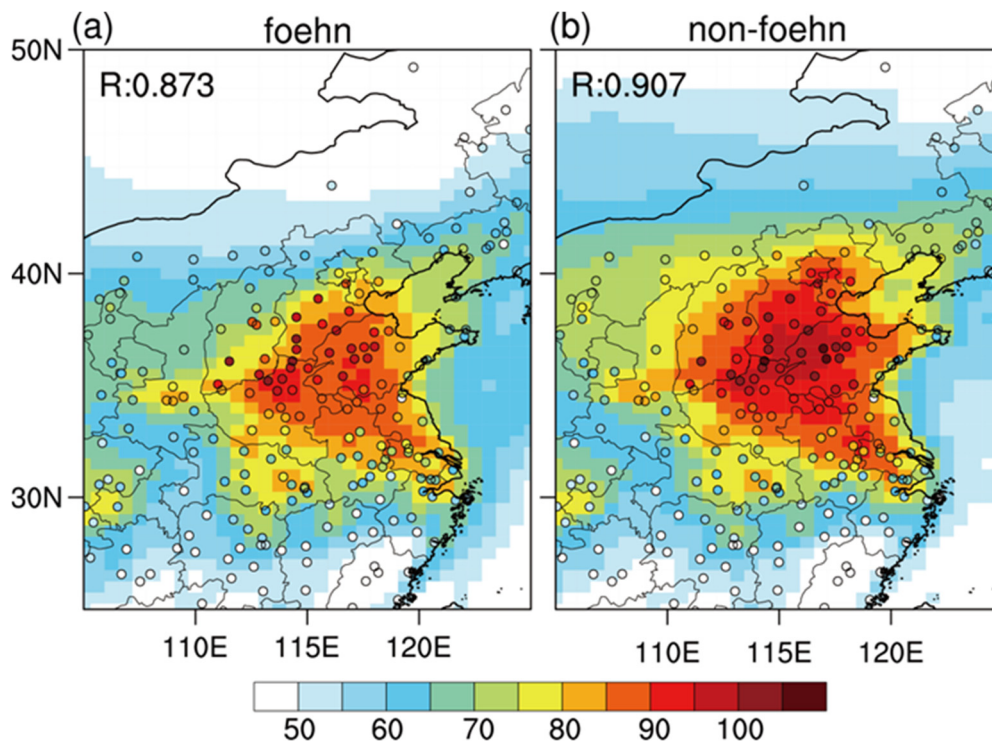
30 **Figure S3.** Temperature anomalies under (a) cyclonic-like circulation and (b) anticyclone circulation.

31 The black rectangles denote the NCP. Anomalies are calculated by subtracting the corresponding

32 multi-year mean for June, July, and August, respectively.



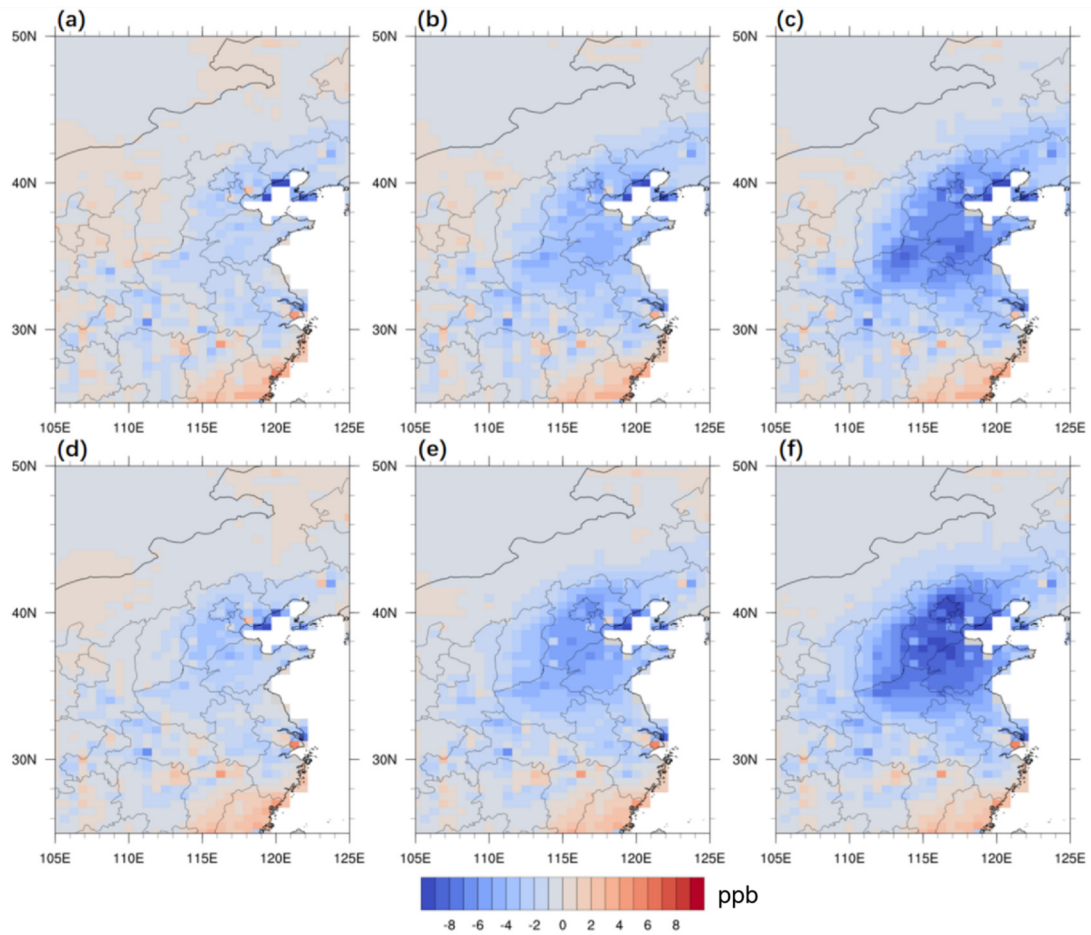
34 **Figure S4.** Spatial pattern of the 850 hPa wind field (vectors) and surface temperature
 35 (filled colors) on 5 June 2022.



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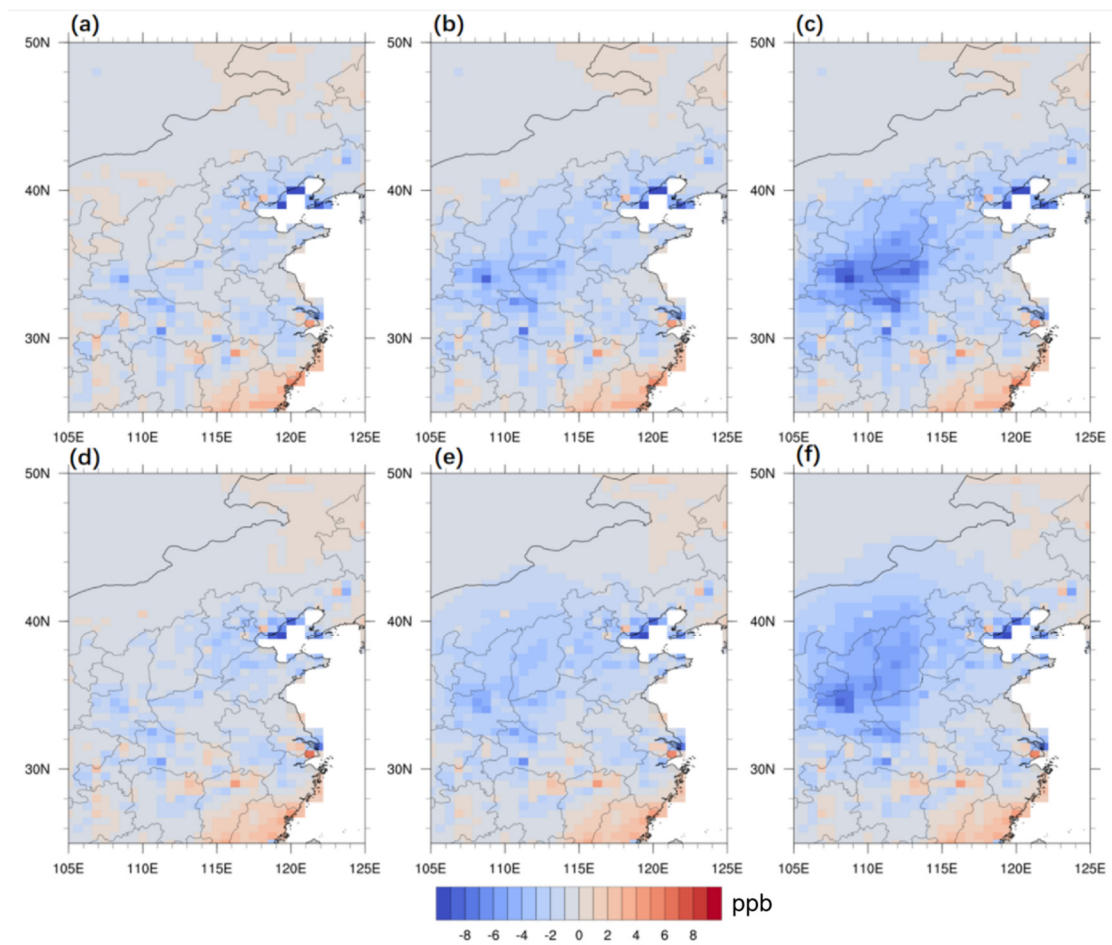
37 **Figure S5.** Validation of the simulated MDA8 ozone concentrations against the
 38 observed data under (a) cyclonic-like circulation and (b) anticyclonic circulation.
 39 Filled colors represent the simulation results and dots denote the observations.
 40 R-value in the upper left is the correlation coefficient between simulations and
 41 observations.

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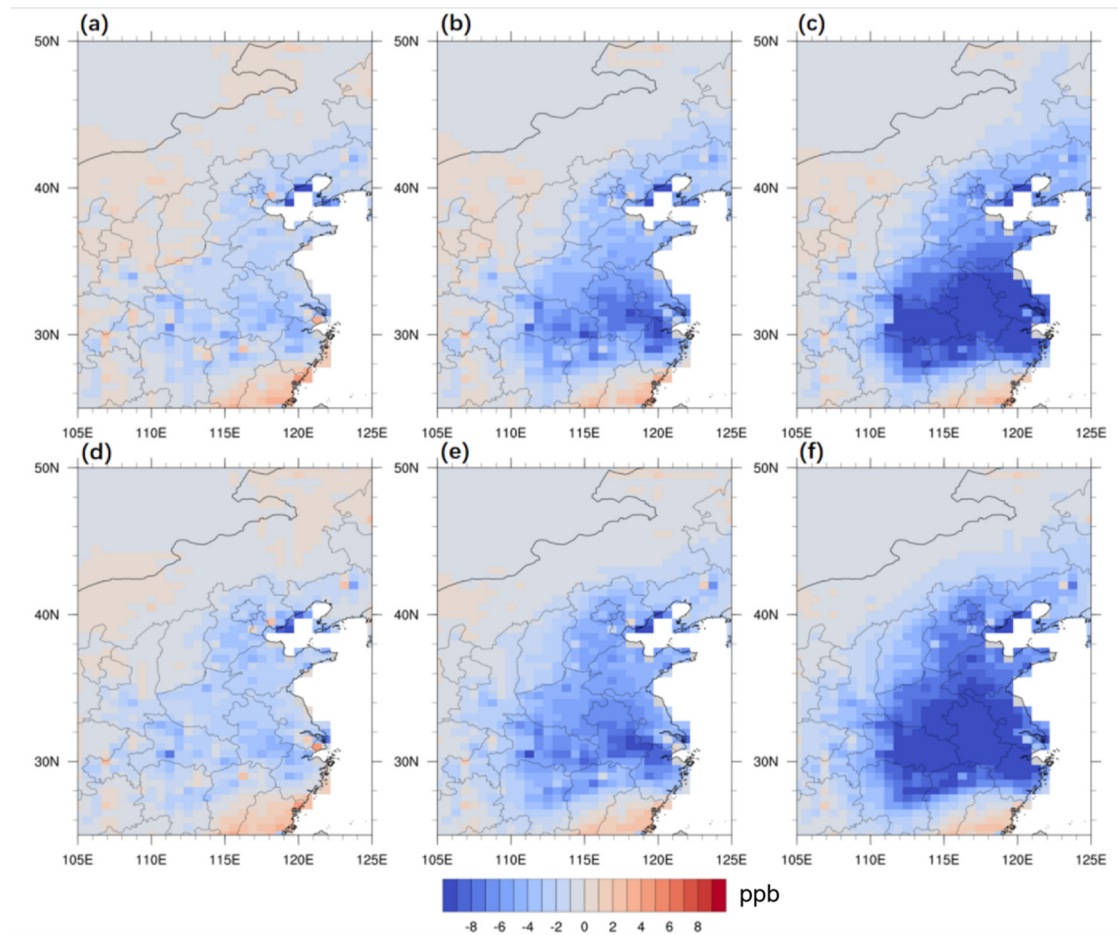
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44 **Figure S6.** Response of MDA8 ozone concentration to (a, d) 10%, (b, e) 30%, and (c,
 45 f) 50% reductions in both NO_x and VOCs emissions over the NCP region under
 46 cyclonic-like circulation (upper panel) and anticyclonic circulation (lower panel).



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48 **Figure S7.** Response of MDA8 ozone concentration to (a, d) 10%, (b, e) 30%, and (c,
 49 f) 50% reductions in both NO_x and VOCs emissions over the NW region under
 50 cyclonic-like circulation (upper panel) and anticyclonic circulation (lower panel).



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52 **Figure S8.** Response of MDA8 ozone concentration to (a, d) 10%, (b, e) 30%, and (c,
 53 f) 50% reductions in both NO_x and VOCs emissions over the SE region under
 54 cyclonic-like circulation (upper panel) and anticyclonic circulation (lower panel).