

1 Supplementary Materials of "Targeted Emission Controls for
2 Ozone Pollution Mitigation based on Mesoscale Weather Pattern
3 Classifications in China's Pearl River Delta Region"

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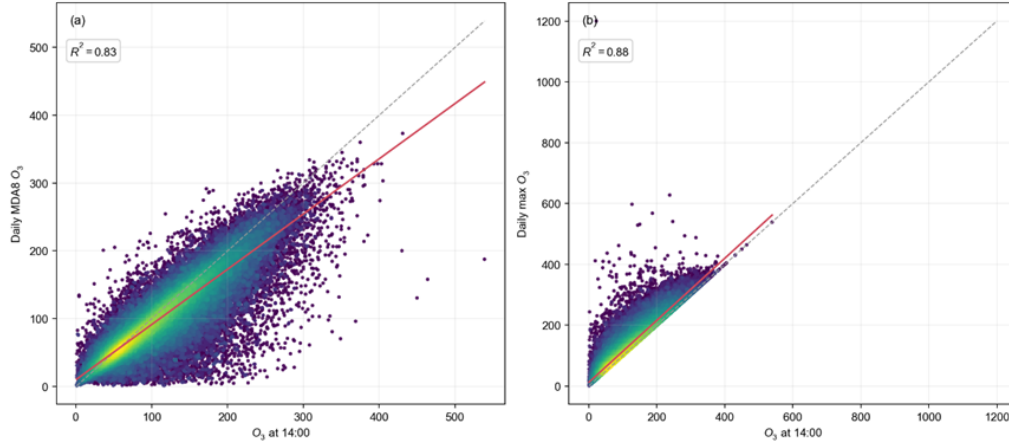


Figure S1: Scatterplots showing the relationships (a) between the MDA8O₃ concentrations and the observed surface ozone concentrations at 14:00 local time, and (b) between the observed daily maximum ozone concentrations and the observed surface ozone concentrations at 14:00 local time over PRD sites during May to October of the years 2015 to 2023. The correlation coefficients R^2 are shown inset. All units are $\mu\text{g}/\text{m}^3$. The dashed lines denote the 1:1 line, and the red lines indicate the reduced major-axis regression lines. Colors indicate the density of data points.

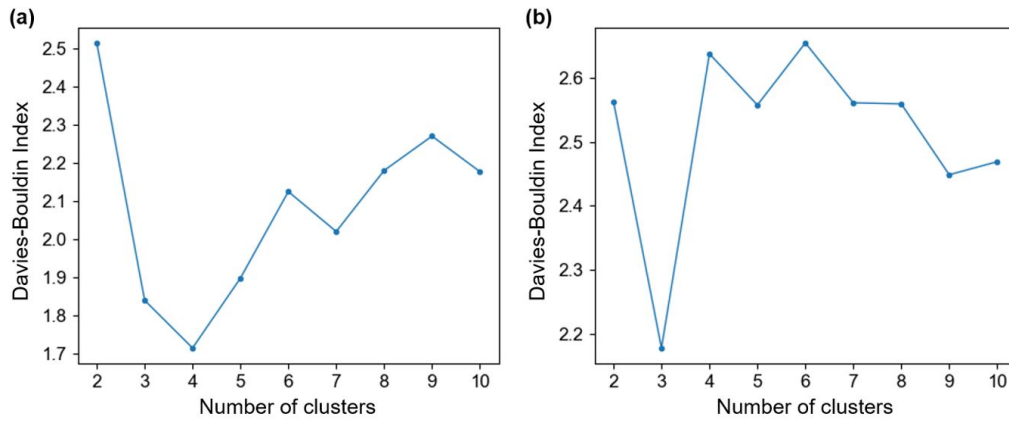


Figure S2: The Davies-Bouldin Index (DBI) as a function of number of clusters for SOMs of (a) mesoscale meteorology and (b) synoptic scale meteorology.

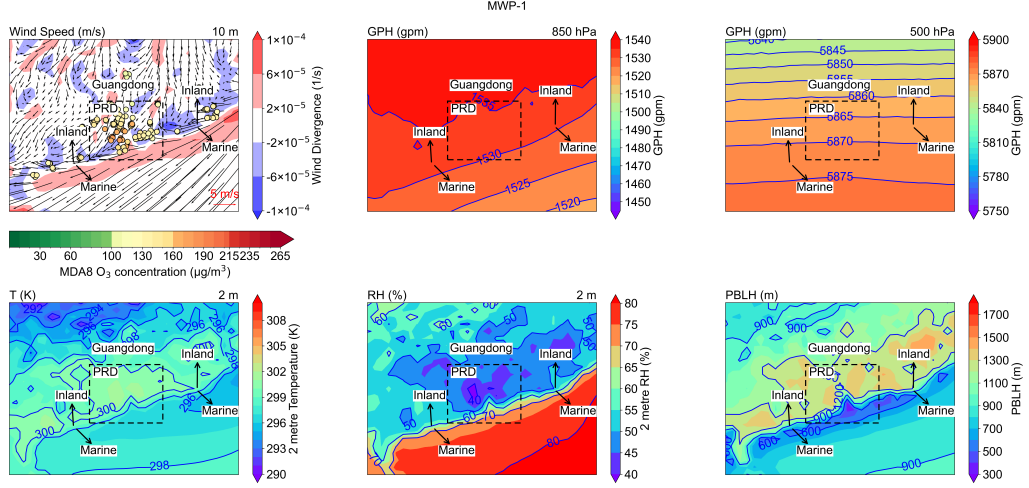


Figure S3: Composites of mesoscale meteorological fields associated with MWP-1: surface winds, surface wind divergence (colored contours in top-left panel), 850 hPa geopotential height, 500 hPa geopotential height, 2 m temperature, 2 m relative humidity, and PBLH. Also shown are the composites of measured MDA8O₃ concentrations at surface sites (top left panel). Dashed boxes and text-arrow annotations schematically indicate the approximate location of the PRD and the inland and marine sides of the domain.

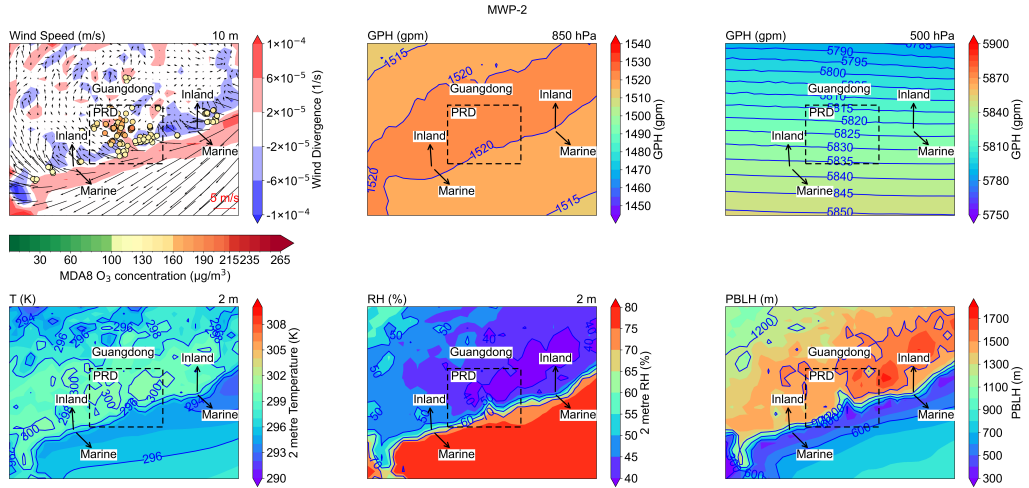


Figure S4: Composites of mesoscale meteorological fields associated with MWP-2: surface winds, surface wind divergence (colored contours in top-left panel), 850 hPa geopotential height, 500 hPa geopotential height, 2 m temperature, 2 m relative humidity, and PBLH. Also shown are the composites of measured MDA8O₃ concentrations at surface sites (top left panel). Dashed boxes and text-arrow annotations schematically indicate the approximate location of the PRD and the inland and marine sides of the domain.

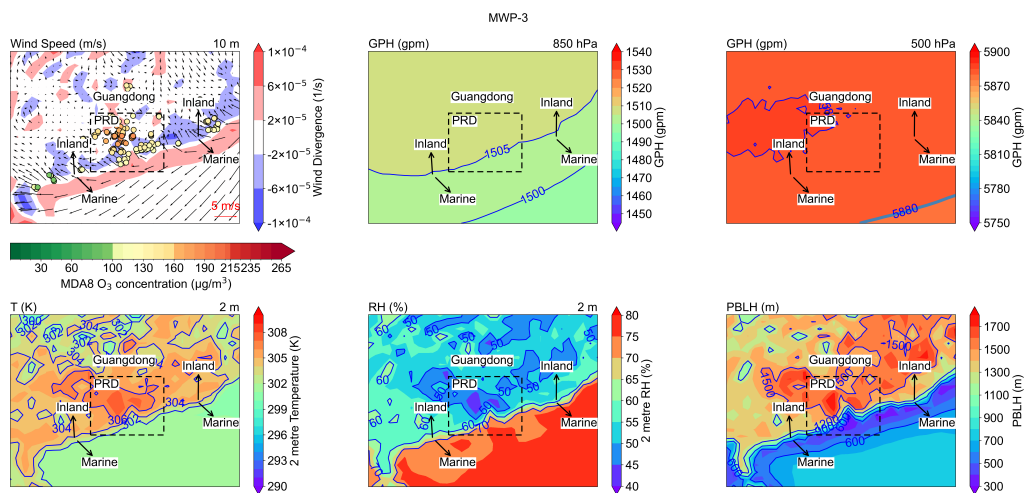


Figure S5: Composites of mesoscale meteorological fields associated with MWP-3: surface winds, surface wind divergence (colored contours in top-left panel), 850 hPa geopotential height, 500 hPa geopotential height, 2 m temperature, 2 m relative humidity, and PBLH. Also shown are the composites of measured MDA8O₃ concentrations at surface sites (top left panel). Dashed boxes and text-arrow annotations schematically indicate the approximate location of the PRD and the inland and marine sides of the domain.

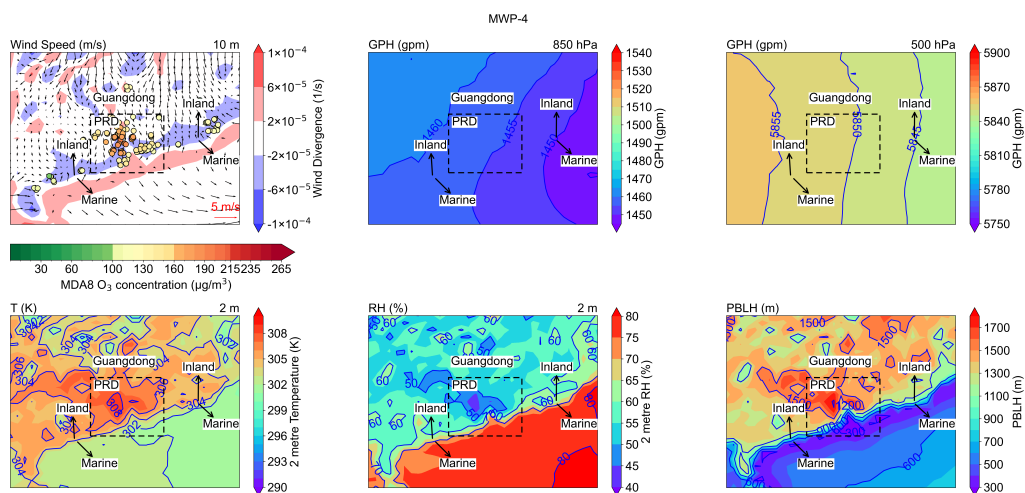


Figure S6: Composites of mesoscale meteorological fields associated with MWP-4: surface winds, surface wind divergence (colored contours in top-left panel), 850 hPa geopotential height, 500 hPa geopotential height, 2 m temperature, 2 m relative humidity, and PBLH. Also shown are the composites of measured MDA8O₃ concentrations at surface sites (top left panel). Dashed boxes and text-arrow annotations schematically indicate the approximate location of the PRD and the inland and marine sides of the domain.

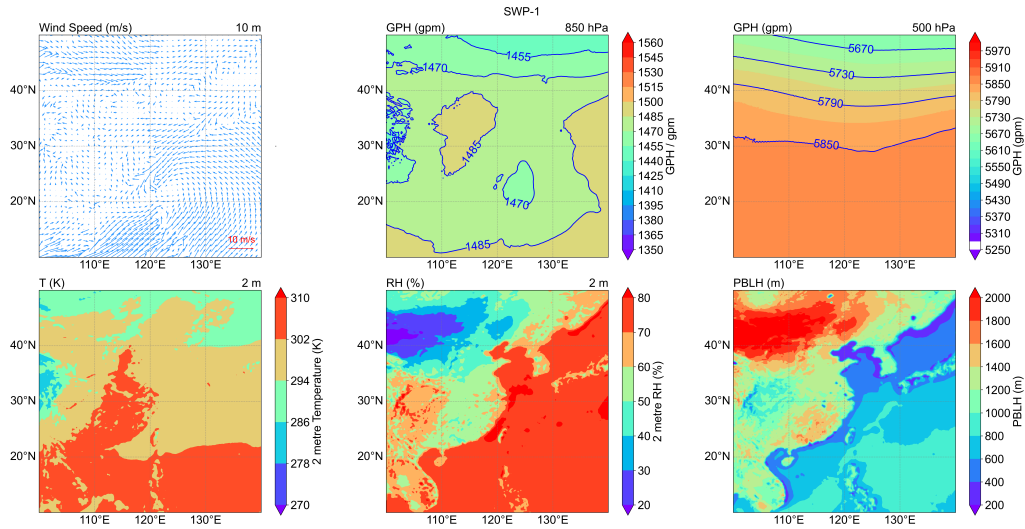


Figure S7: Composites of synoptic scale meteorological fields associated with SWP-1: surface winds, 850 hPa geopotential height, 500 hPa geopotential height, 2 m temperature, 2 m relative humidity, and PBLH.

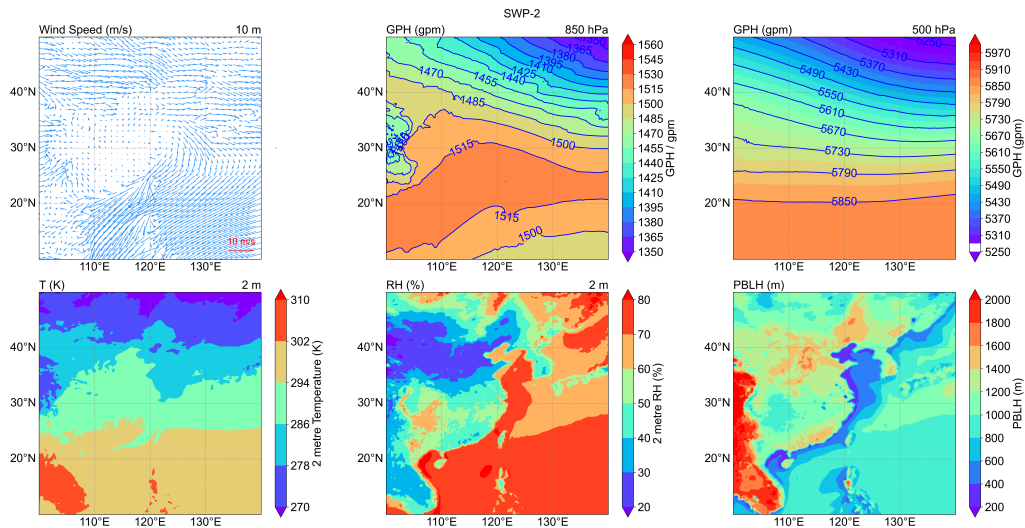


Figure S8: Composites of synoptic scale meteorological fields associated with SWP-2: surface winds, 850 hPa geopotential height, 500 hPa geopotential height, 2 m temperature, 2 m relative humidity, and PBLH.

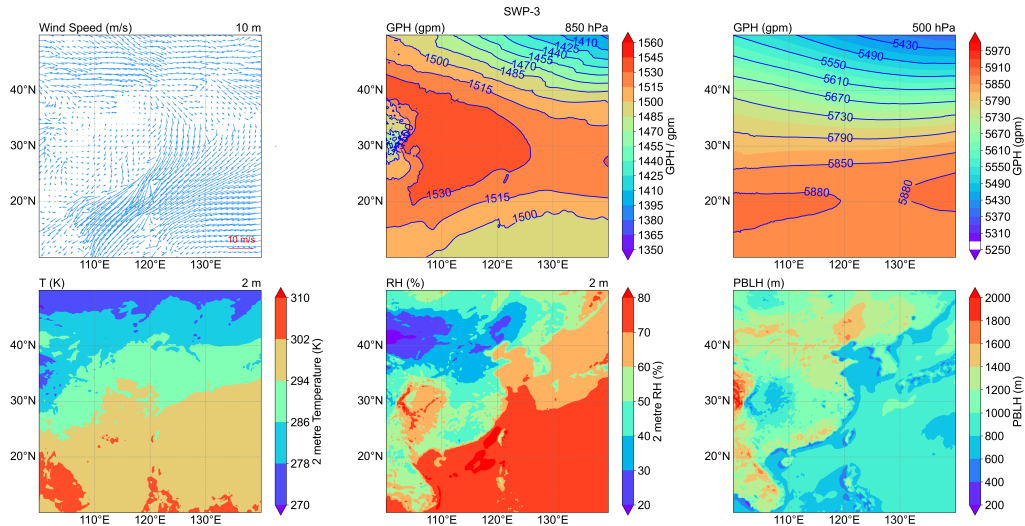


Figure S9: Composites of synoptic scale meteorological fields associated with SWP-3: surface winds, 850 hPa geopotential height, 500 hPa geopotential height, 2 m temperature, 2 m relative humidity, and PBLH.

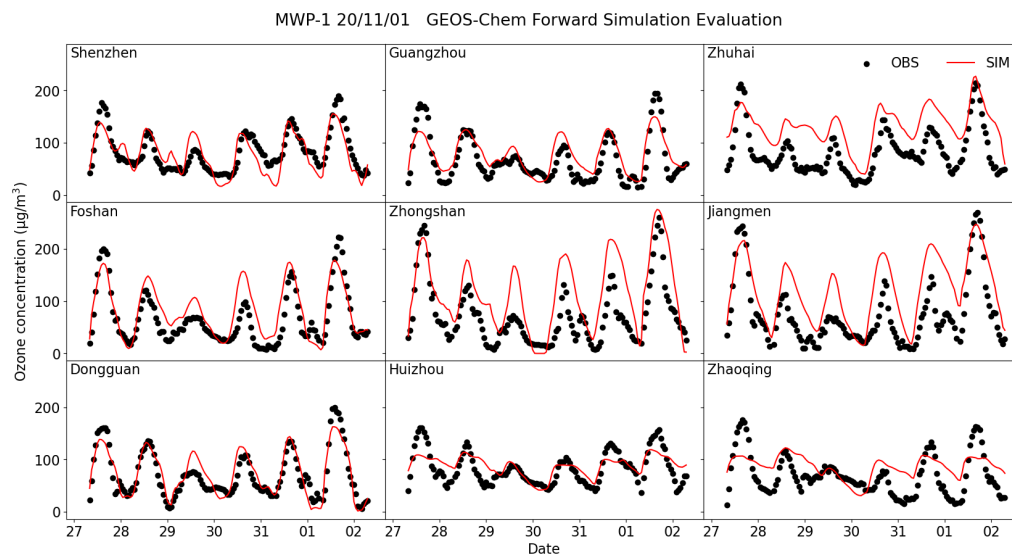


Figure S10: Observed (dots) and GEOS-Chem simulated (lines) surface ozone concentrations in nine PRD cities before and during Episode 1.

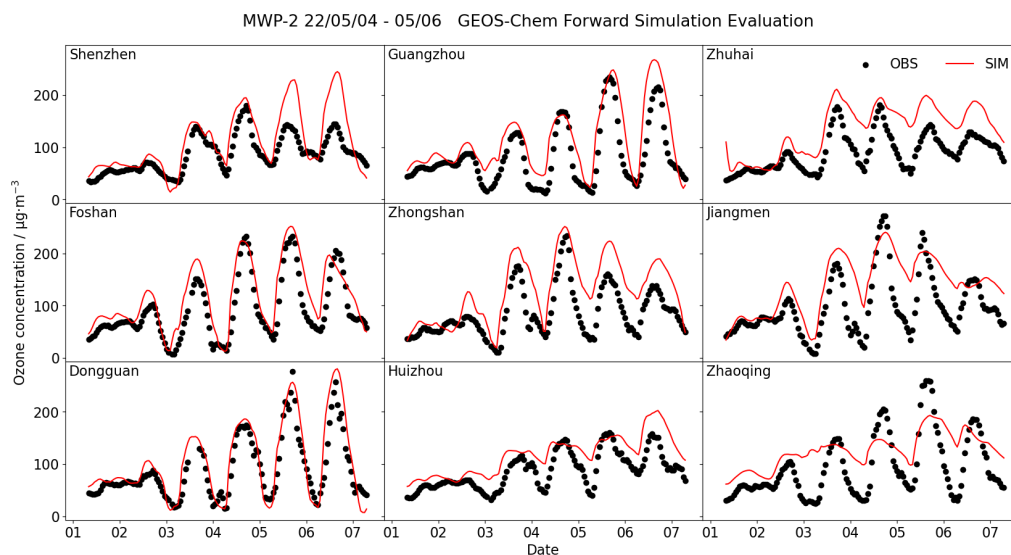


Figure S11: Observed (dots) and GEOS-Chem simulated (lines) surface ozone concentrations in nine PRD cities before and during Episode 2.

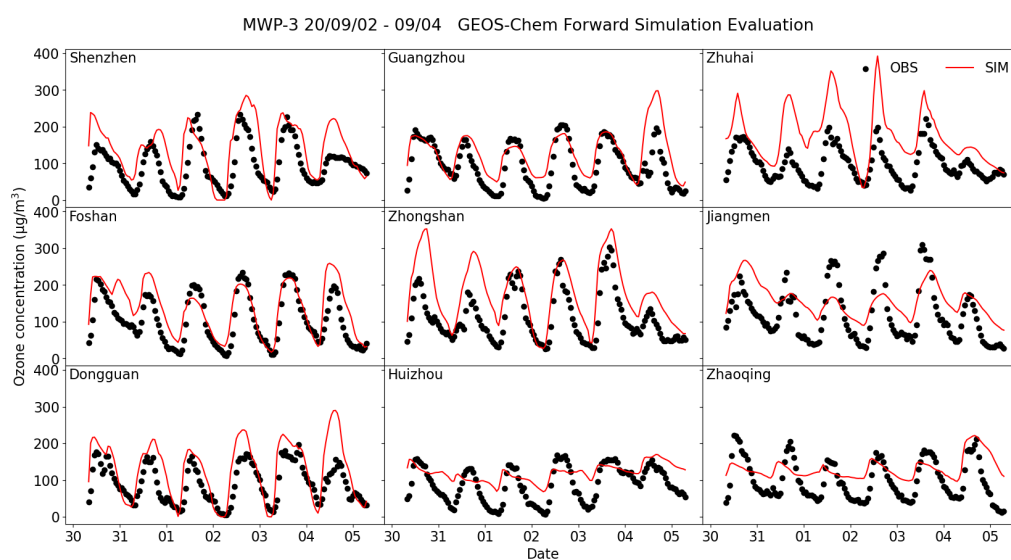


Figure S12: Observed (dots) and GEOS-Chem simulated (lines) surface ozone concentrations in nine PRD cities before and during Episode 3.

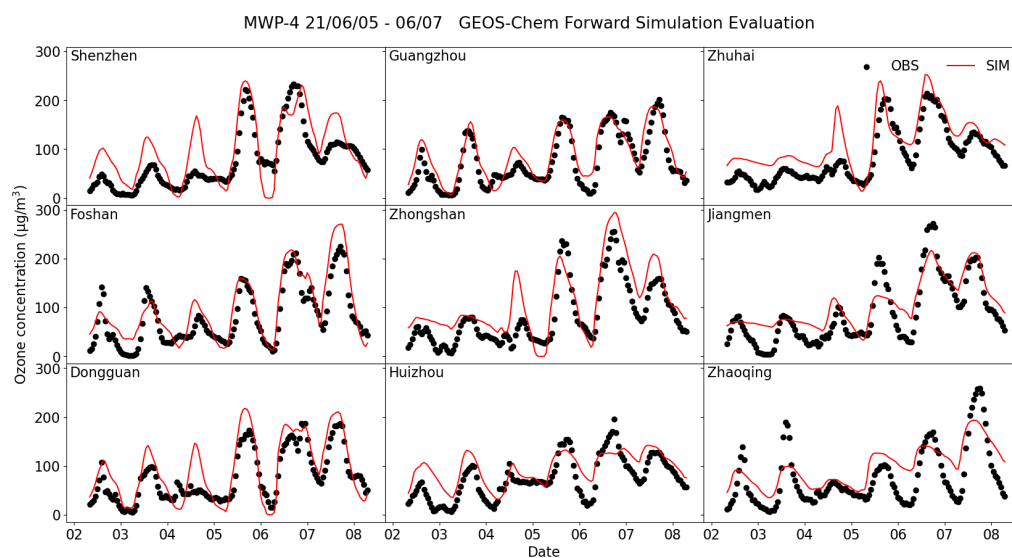


Figure S13: Observed (dots) and GEOS-Chem simulated (lines) surface ozone concentrations in nine PRD cities before and during Episode 4.

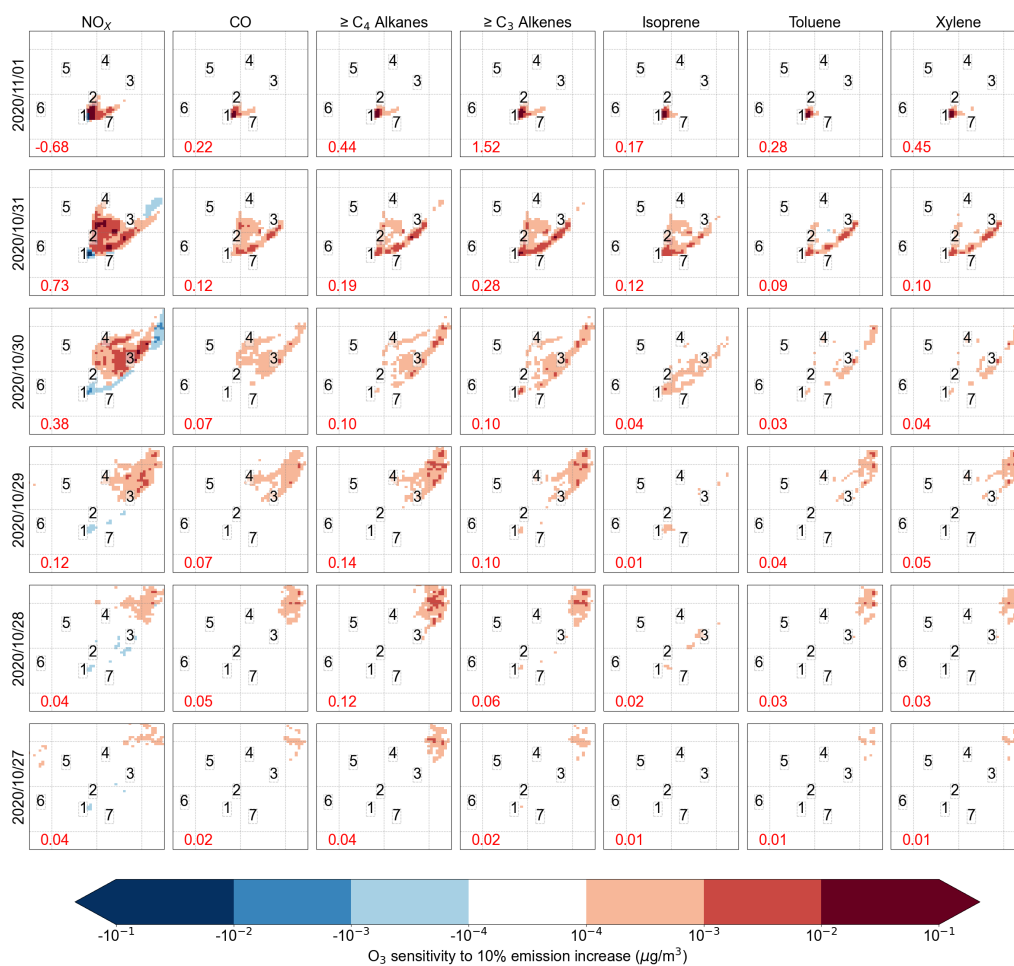


Figure S14: Spatial distribution of the sensitivity of surface ozone in Shenzhen (unit: $\mu\text{g}/\text{m}^3$) to a 10% emission increase of precursors from upwind model grids during the days leading up to Episode 1 (November 1, 2020). The sum of ozone sensitivity over the plotted domain (unit: $\mu\text{g}/\text{m}^3$) associated with each precursor are shown inset.

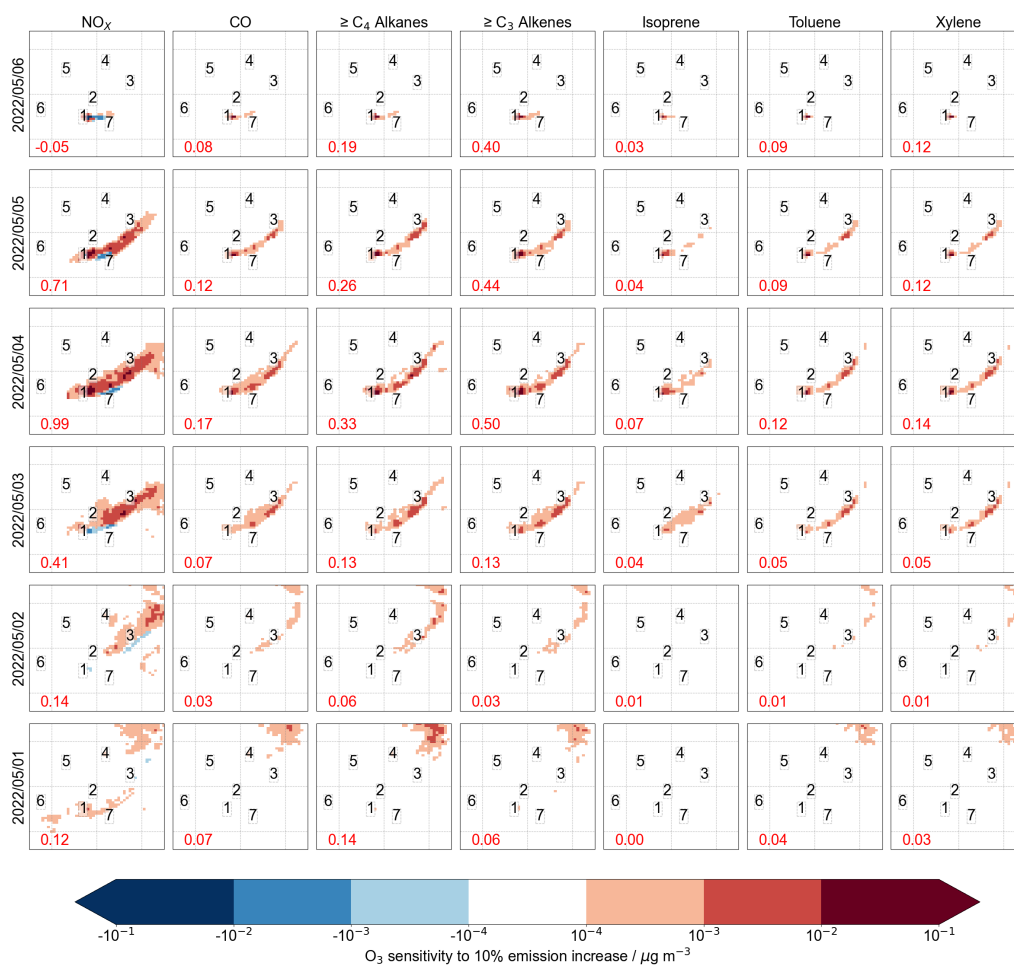


Figure S15: Spatial distribution of the sensitivity of surface ozone in Shenzhen (unit: $\mu\text{g/m}^3$) to a 10% emission increase of precursors from upwind model grids during the days leading up to Episode 2 (May 4-6, 2022). The sum of ozone sensitivity over the plotted domain (unit: $\mu\text{g/m}^3$) associated with each precursor are shown inset.

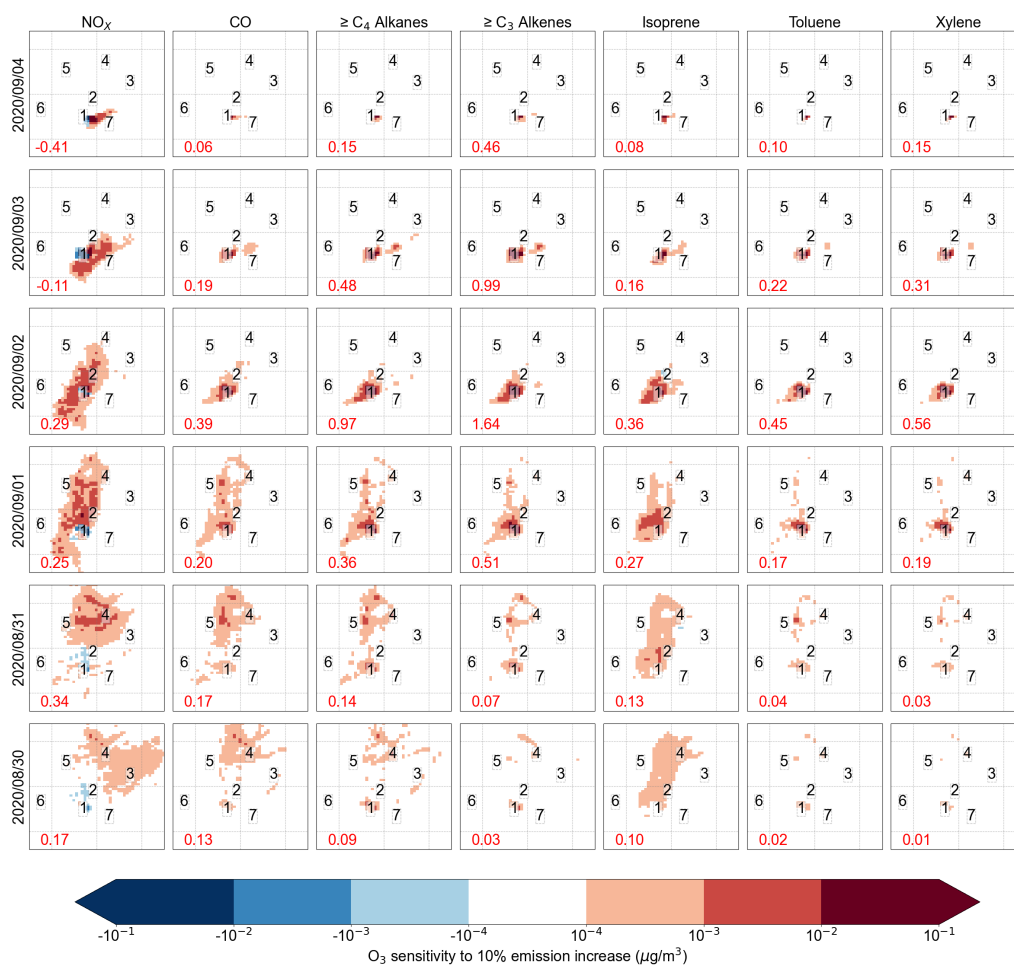


Figure S16: Spatial distribution of the sensitivity of surface ozone in Shenzhen (unit: $\mu\text{g}/\text{m}^3$) to a 10% emission increase of precursors from upwind model grids during the days leading up to Episode 3 (September 2-4, 2020). The sum of ozone sensitivity over the plotted domain (unit: $\mu\text{g}/\text{m}^3$) associated with each precursor are shown inset.

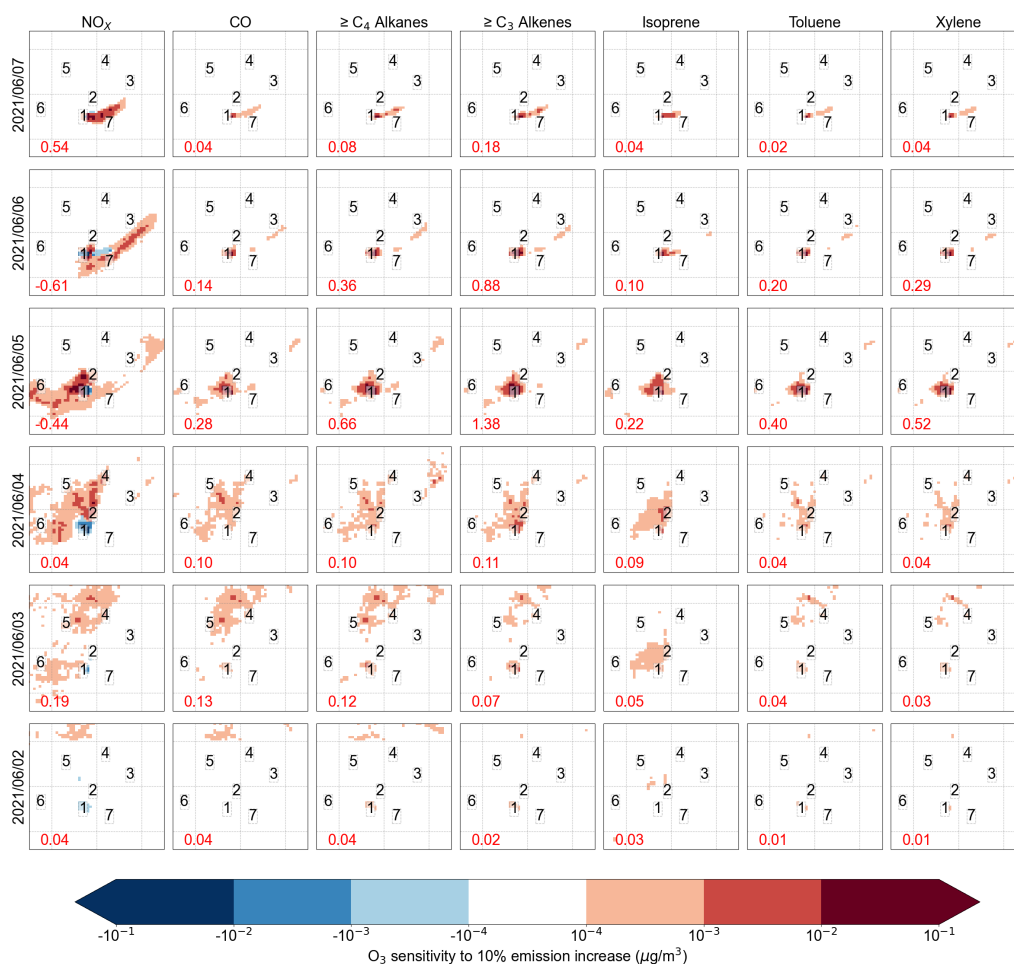


Figure S17: Spatial distribution of the sensitivity of surface ozone in Shenzhen (unit: $\mu\text{g}/\text{m}^3$) to a 10% emission increase of precursors from upwind model grids during the days leading up to Episode 4 (June 5-7, 2021). The sum of ozone sensitivity over the plotted domain (unit: $\mu\text{g}/\text{m}^3$) associated with each precursor are shown inset.