Supporting Information

Sources and processes affecting fine particulate matter pollution over North China: an adjoint analysis of the Beijing APEC period

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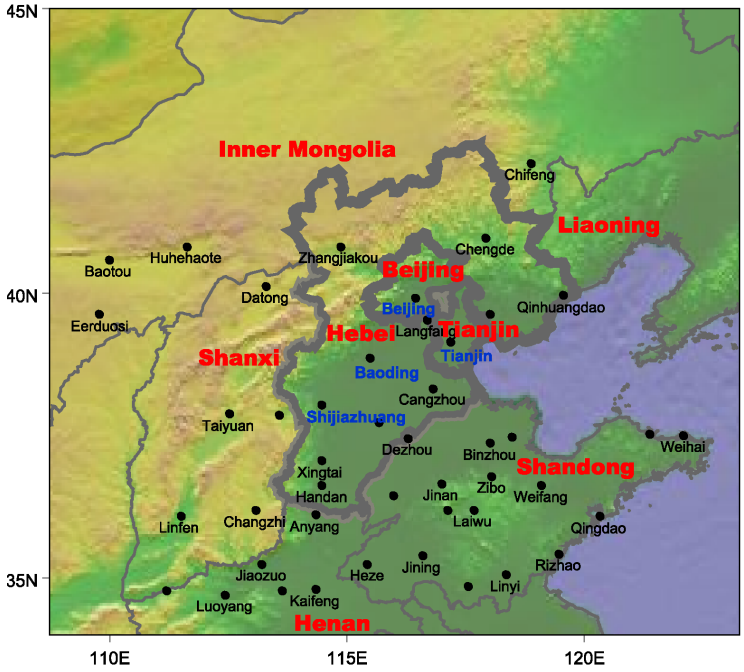


Figure S1. Domain of the study over North China, which includes Beijing City, Tianjin City, Hebei, Shanxi, Shandong, and part of Inner Mongolia, Liaoning, and Henan provinces. The underlying figure shows terrain elevations (from www.ngdc.noaa.gov/mgg/topo/pictures/GLOBALeb3colshade.jpg). The black dots denote locations of the CNEMC surface monitoring sites with the city names labeled below. The thick grey lines cover the Beijing-Tianjin-Hebei (BTH) municipalities.

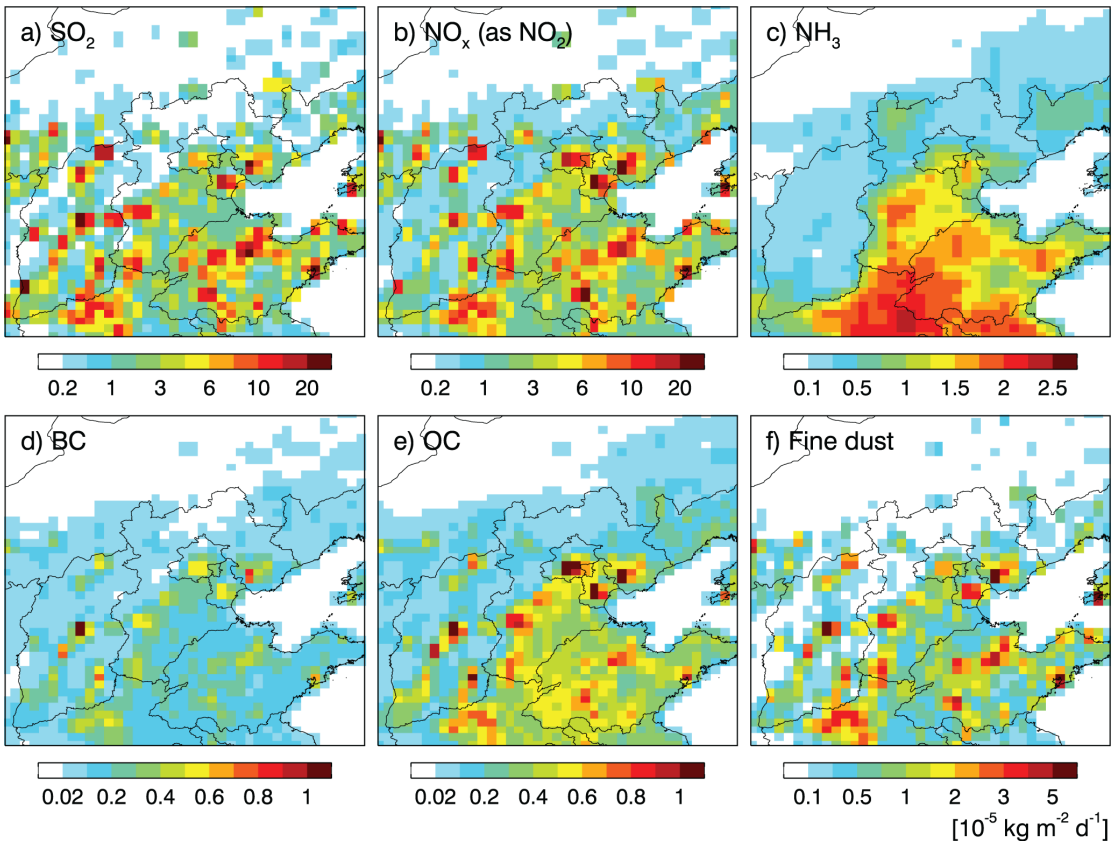
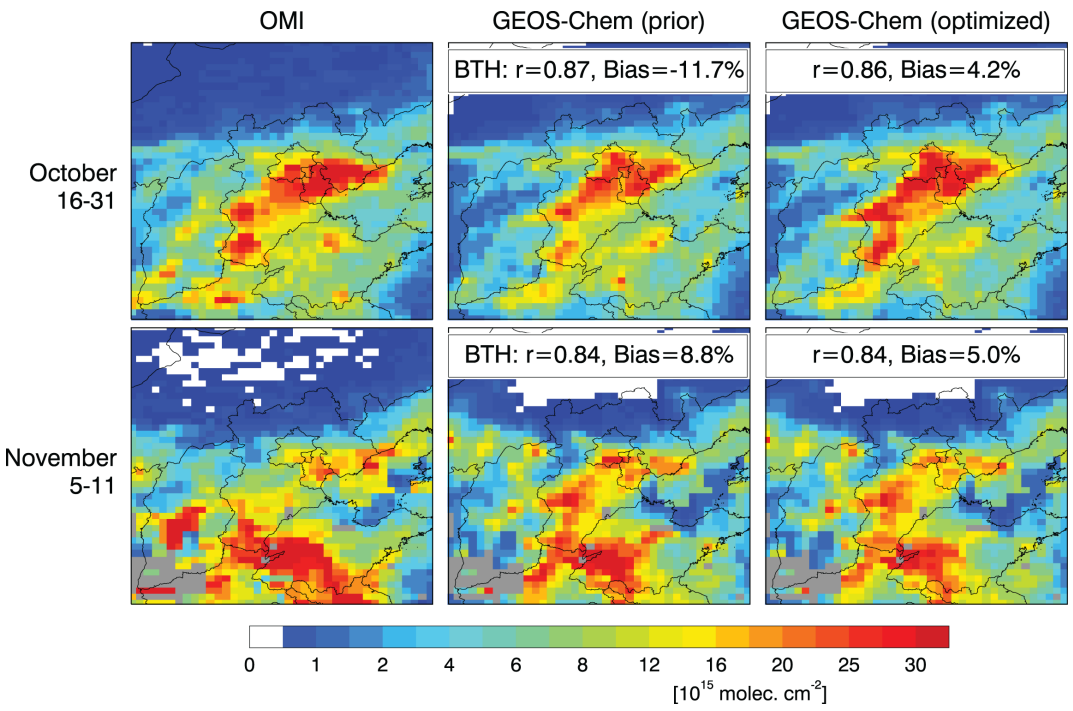


Figure S2. Anthropogenic emissions of SO_2, NO_x, NH_3, black carbon (BC), organic carbon (OC), and fine dust over North China. Emission rates are from the Multi-resolution Emission Inventory of China (MEIC; http://www.meicmodel.org) for October 2010 except for NH_3 emissions that are from REAS-v2 with an improved seasonal variability applied.



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42 **Figure S3**. OMI observed and GEOS-Chem simulated NO_2 tropospheric columns

43 over North China averaged for October 16-31 and November 5-11 (the APEC period),

44 2014. The KNMI DOMINO NO_2 data (left column) are compared with model

45 simulations with prior emissions (middle column) and with optimized emissions (right

46 column). Model results are sampled along the satellite orbits at the overpass time

47 (13:45 local time) and applied with the averaging kernel. Both observations and

48 model results are then regrided to the model resolution (1/4° × 5/16°). The correlation

49 coefficients (*r*) and mean model biases over the BTH region are shown inset.

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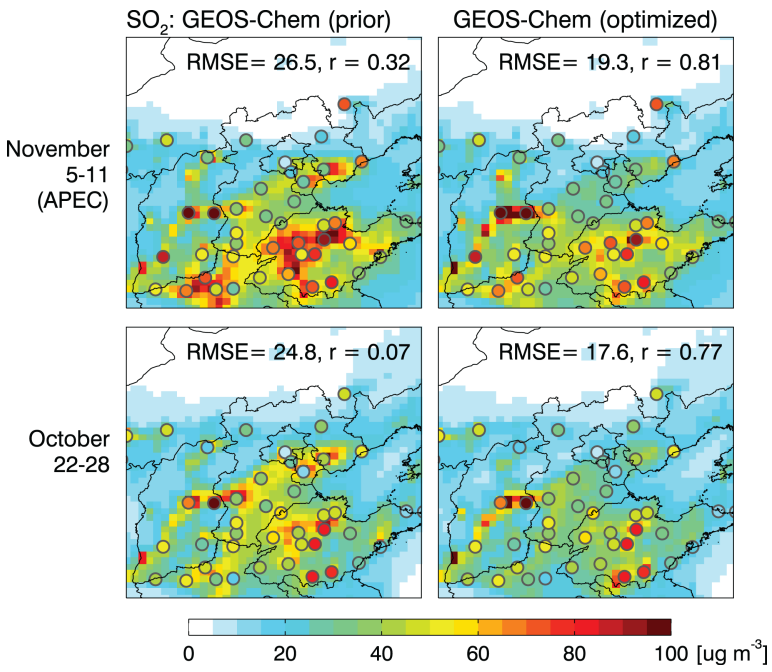

Figure S4. Surface mass concentrations of SO_2 averaged over two weeks: November 5-11 (the APEC week) and October 22-28, 2014. Measurements from CNEMC (circles) are over-plotted over model simulations with prior emissions (left column) and with optimized emissions (right column). The observation versus model correlation coefficient (r) and root mean square error (RMSE) are shown inset.

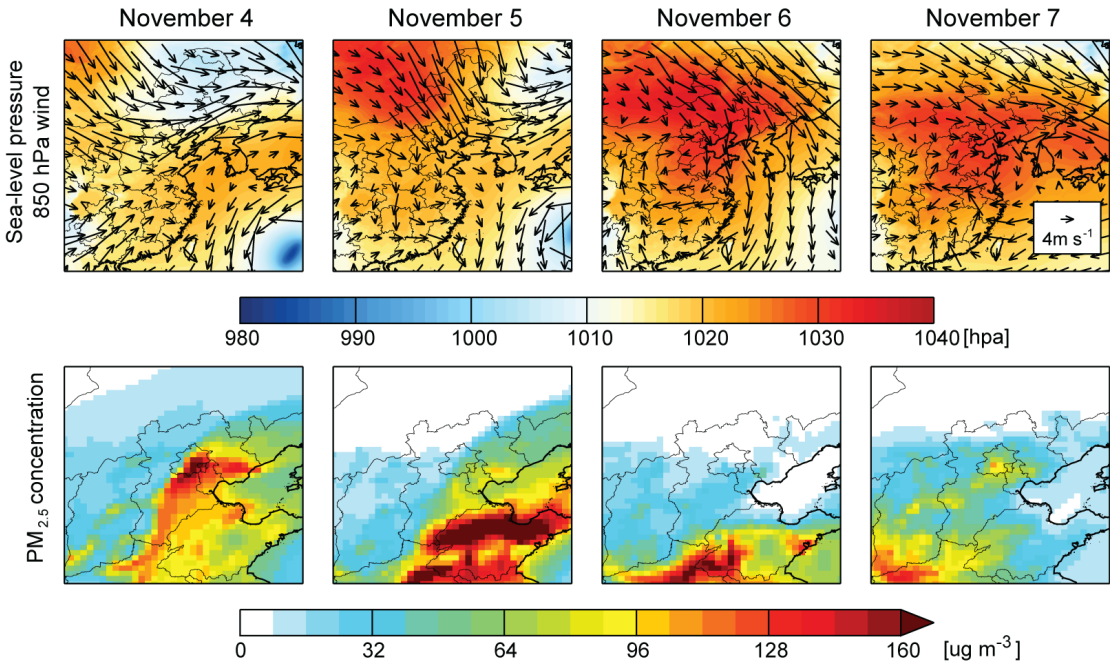

Figure S5. Evolution of surface $PM_{2.5}$ concentrations over the North China Plain during November 4-7, 2014. The top panels show daily mean sea-level pressure and wind fields at 850 hPa from the GEOS-FP meteorological data, and the bottom panels show model simulated daily mean surface $PM_{2.5}$ concentrations.

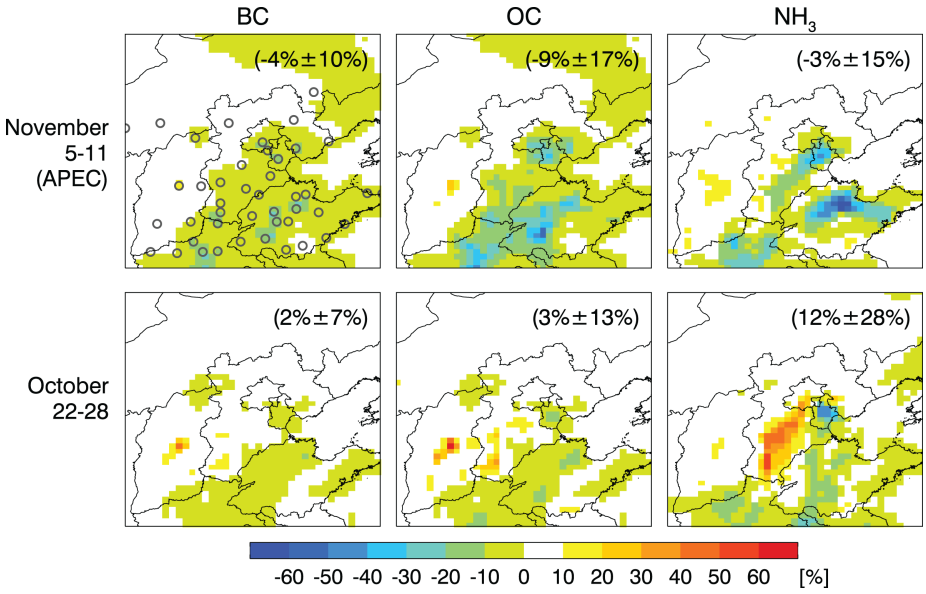

Figure S6. Correction factors in the optimized anthropogenic emissions of BC, OC and NH_3 relative to the prior emissions (Figure S2) averaged for November 5-11 (the APEC week) and October 22-28, 2014. Values in parentheses represent the total emission changes integrated over the BTH region. The grey circles in the top-left panel denote the locations of monitoring cities.