Supplementary Information for

Predictability of fossil fuel CO2 from air quality emissions

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This PDF file includes:

Figs. S1 to S7

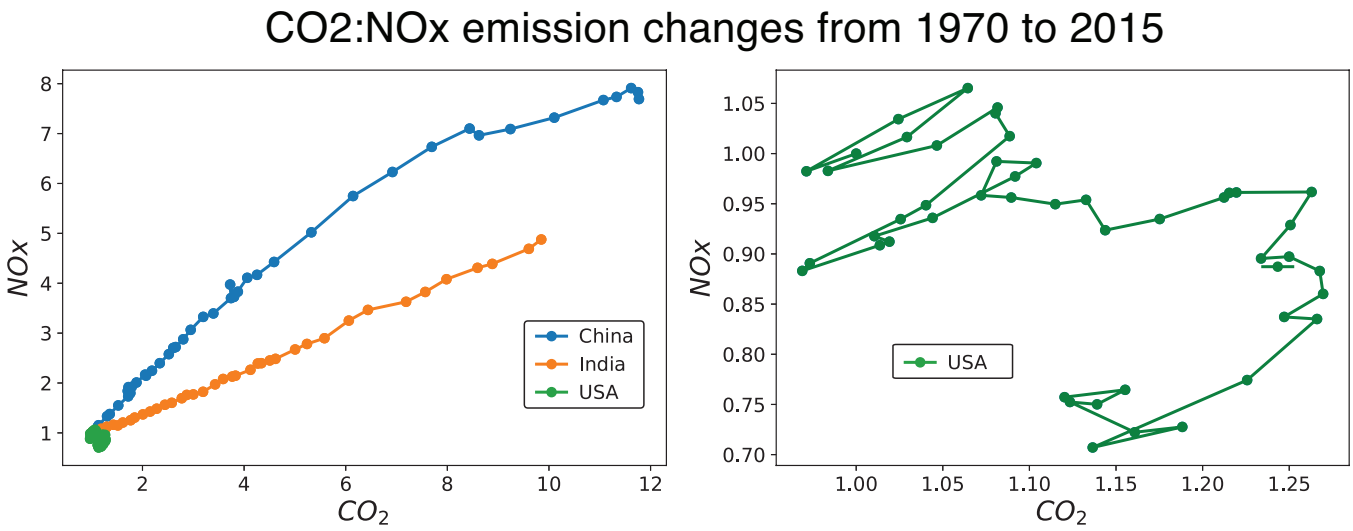

Fig. S1. (left) Co-evolution of country-total anthropogenic emissions of CO2 (x-axis) and NOx (y-axis) from 1970 through 2015 from the EDGAR inventories. The values normalized at the 1970 level are shown for China, India, and USA. (right) Same as the left figure, but the result for the USA only are shown.

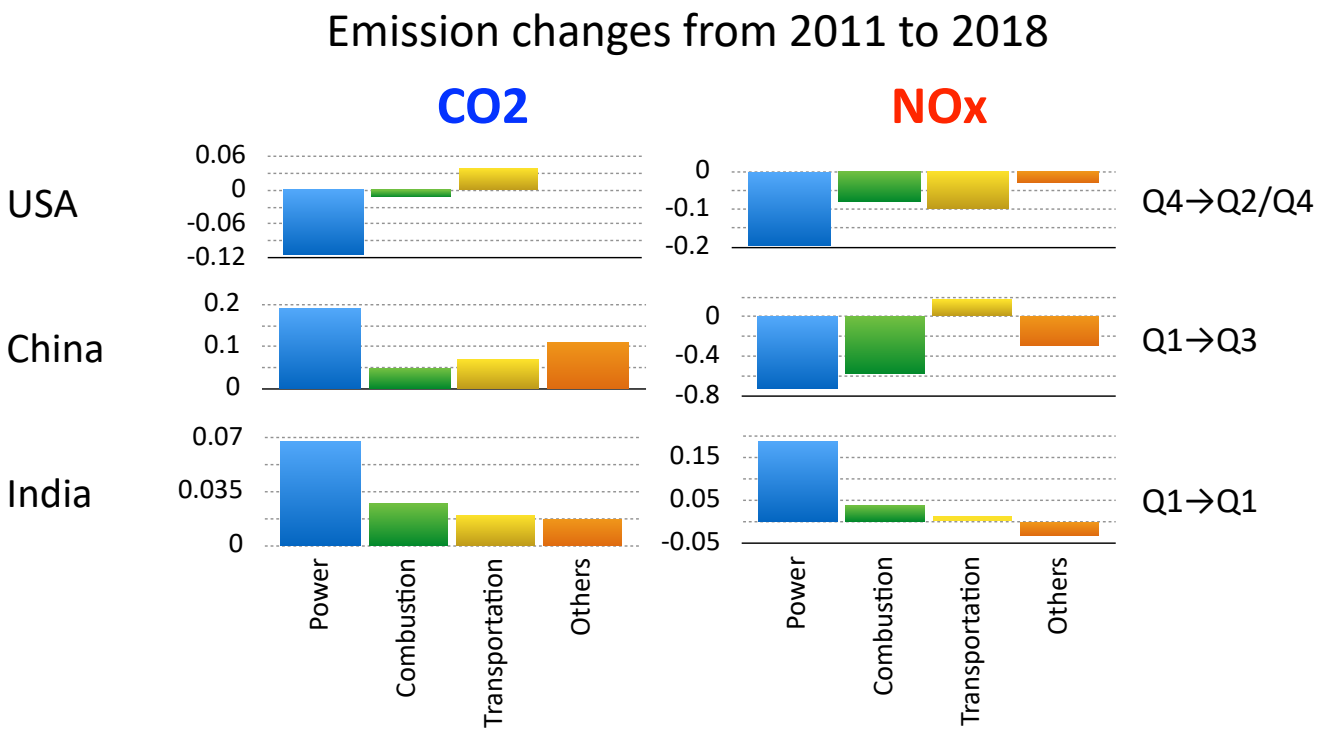

Fig. S2. Changes in annual total emissions from 2011 to 2018 obtained from the EDGAR inventory for each emission sector separately: power industry, combustion for manufacturing, road transportation, and others. The results are shown for China, India, and USA. The unit is PgC for CO2 and TgN for NOx.

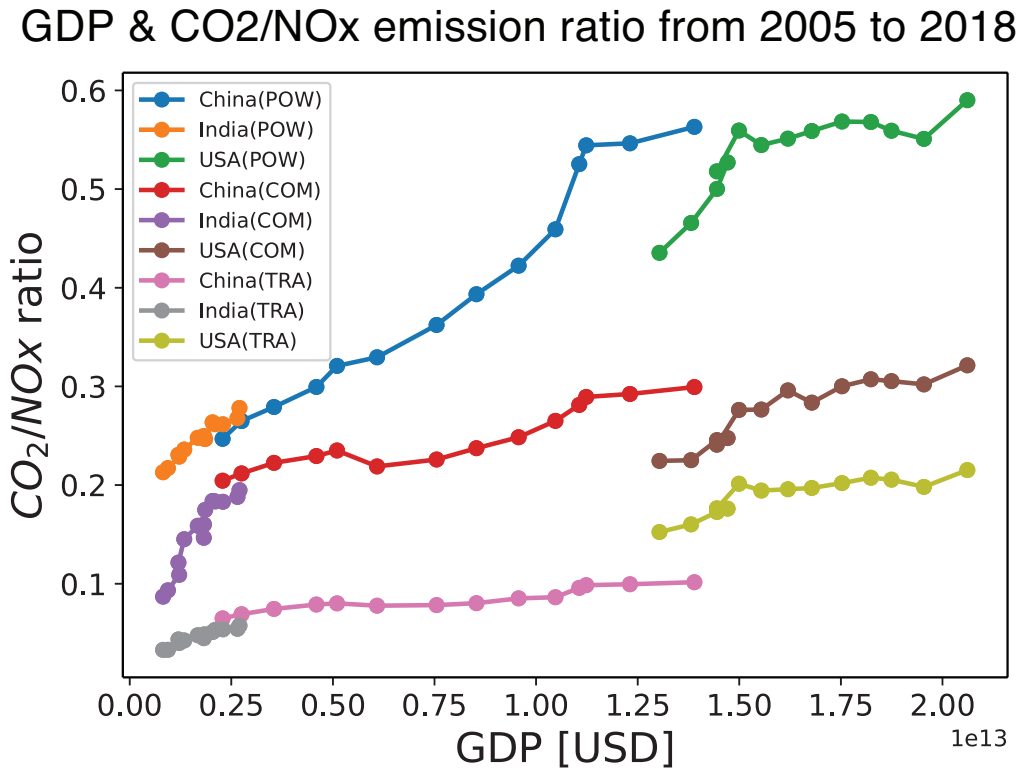

Fig. S3. Relationships between Gross domestic product (GDP, in USD) and CO2/NOx emission ratio for each emission sector separately: power industry, combustion for manufacturing, road transportation. The results are shown for China, India, and USA.

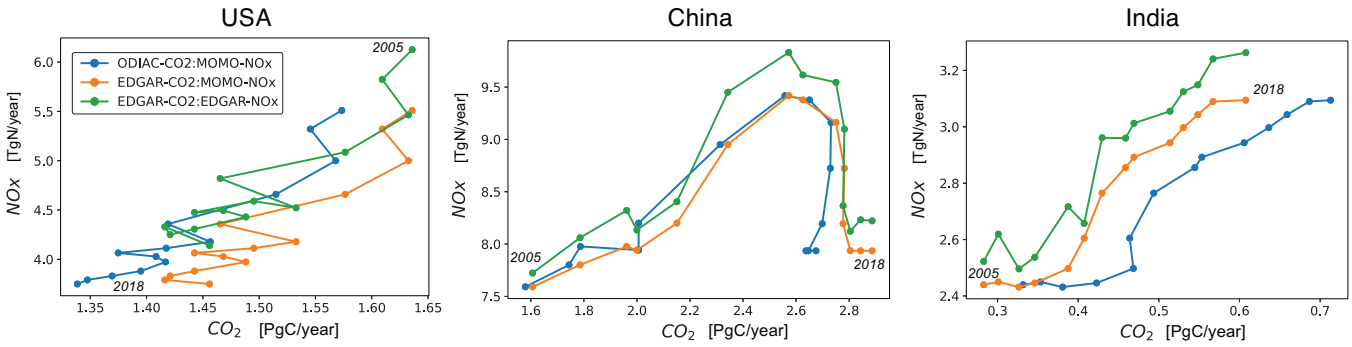

Fig. S4. Co-evolution of CO2 and NOx emissions using different emission inventories for USA, China, and India: ODIAC CO2 and TCR-2 NOx (blue), EDGAR CO2 and TCR-2 NOx (orange), and EDGAR CO2 and EDAR NOx (green).

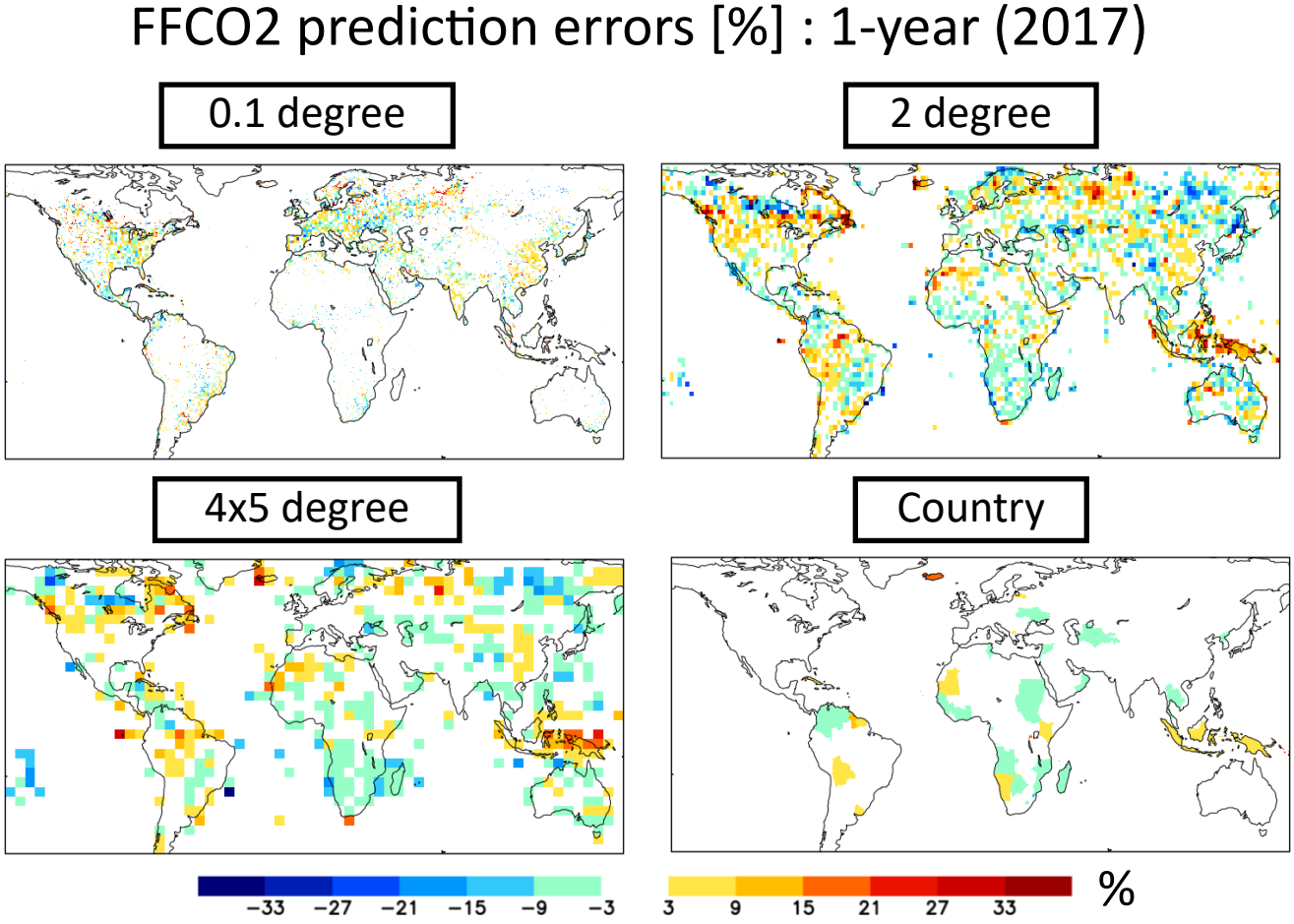

Fig. S5. Spatial maps of 1-year KF prediction errors of FFCO2 in 2017 starting from 2016. The results are shown for relative errors (in %) for KF predictions conducted at different spatial resolutions: 0.1x0.1 degree (native inventory resolution), 2x2 degree, 4x4 degree, and country-scale.

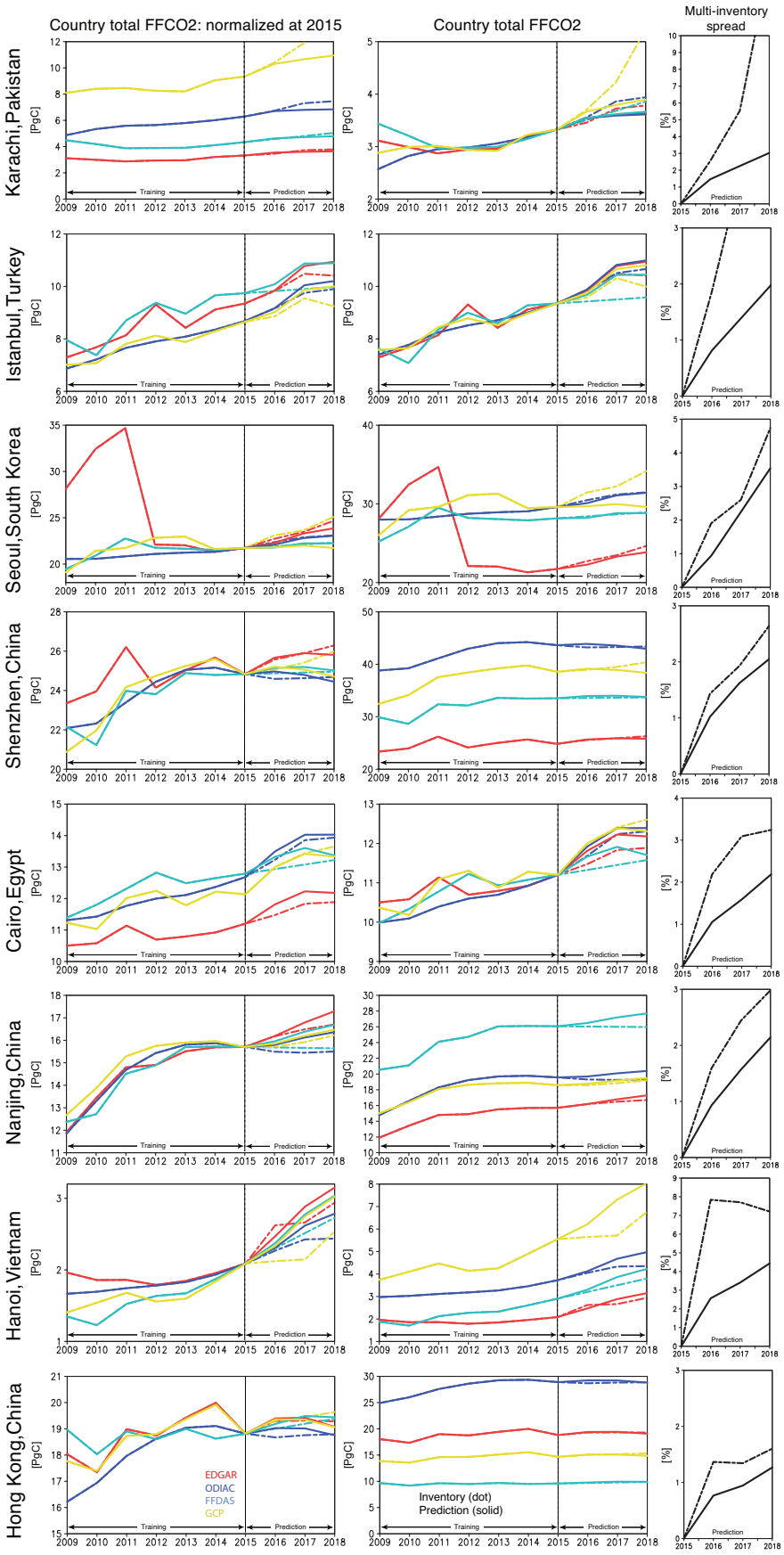

Fig. S6. Same as Fig. 5, but for several selected cities.

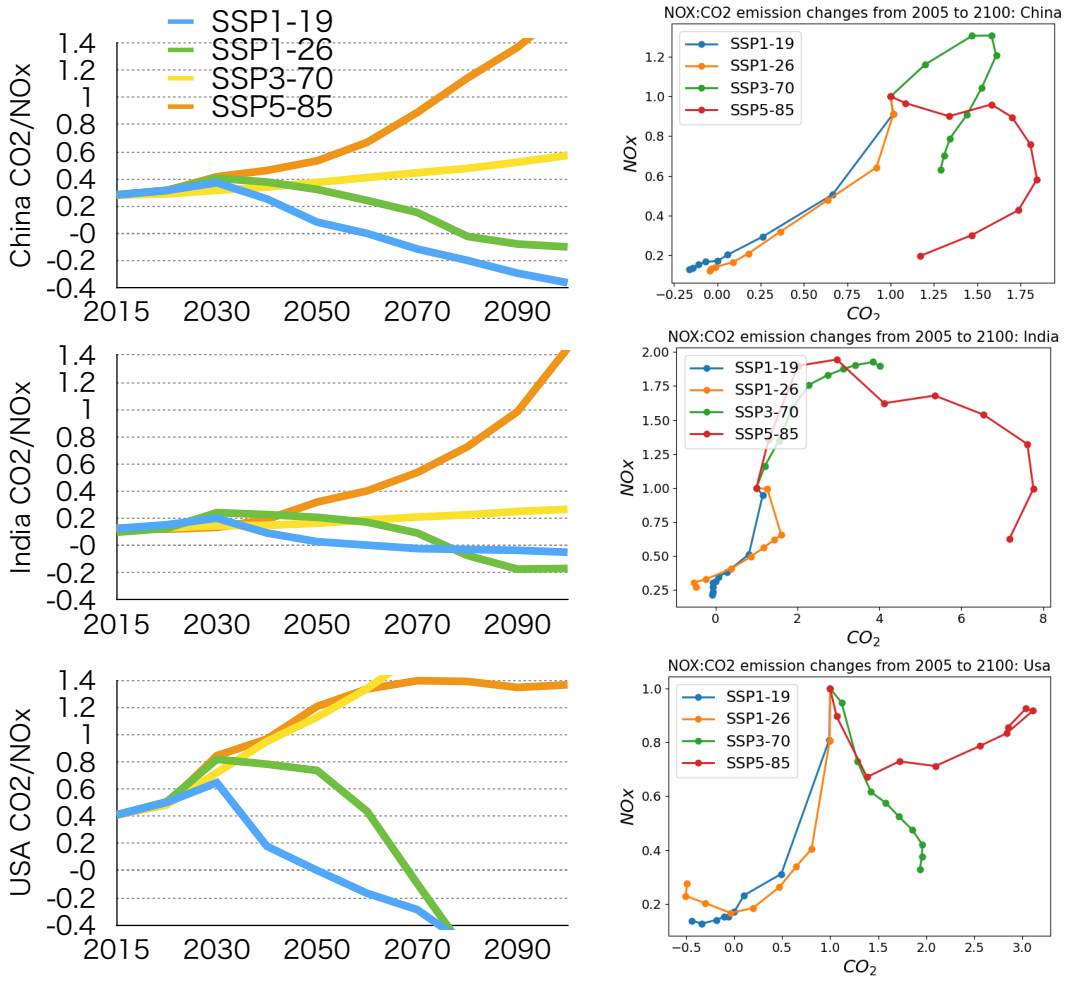

Fig. S7. (left) CO2/NOx emission ratio (in PgC/TgN) changes and (right) co-evolution of CO2 and NOx emissions normalized at the 2015 values obtained from the Shared Socio-economic Pathways (SSPs) scenarios from 2015 to 2100. Here we compare four SSPs: SSP1-19 (the IPCC's most optimistic scenario, where global CO2 emissions are cut to net zero around 2050), SSP1-26 (the next-best scenario. Global CO2 emissions are cut severely, but not as fast, reaching net-zero after 2050), SSP3-70 (emissions and temperatures rise steadily and CO2 emissions roughly double from current levels by 2100), and SSP5-85 (Current CO2 emissions levels roughly double by 2050. The global economy grows quickly, but this growth is fueled by exploiting fossil fuels and energy-intensive lifestyles). The results are shown for