Supplement of

Effect of changing NO_x lifetime on the seasonality and long-term trends of satellite-observed tropospheric NO_2 columns over China

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MEIC NO$_x$ emissions trends over China

2012

2017

[(2017−2012)/2012 x 100] %

0.0 0.25 0.5 0.75 1.0 g km^{-2} s^{-1}
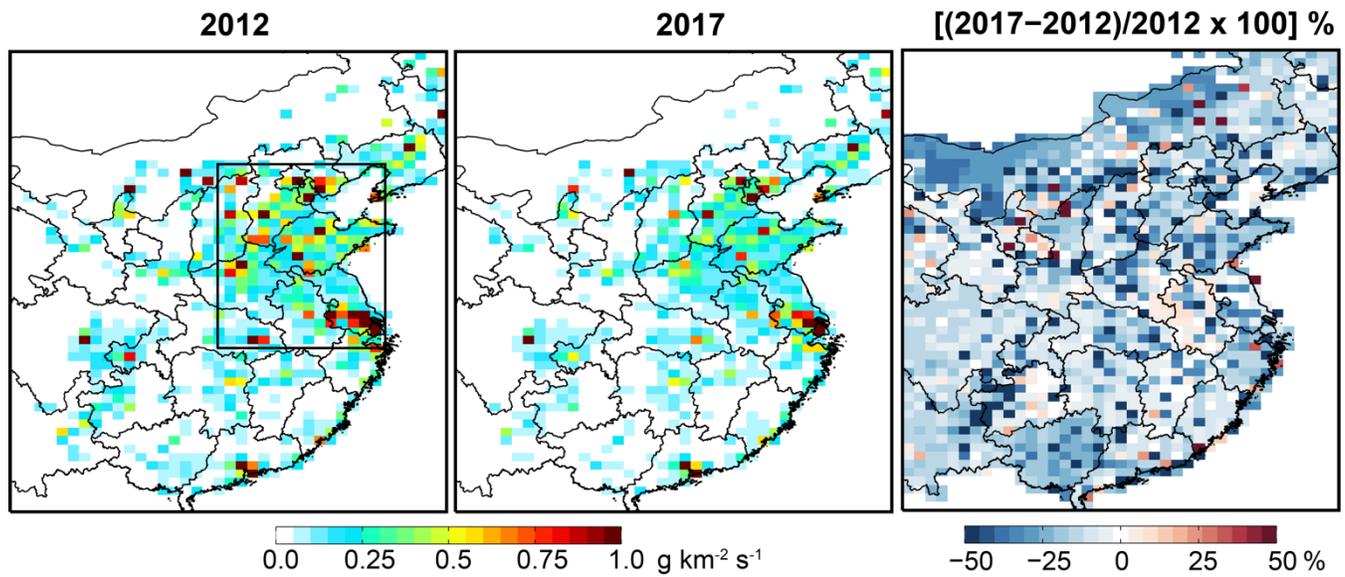
−50 −25 0 25 50 %

Figure S1: Trends in anthropogenic NO$_x$ emissions over China. Left panels show the MEIC NO$_x$ emissions for 2012 and 2017 and the right panels show their percentage change. The rectangle in the left panel delineates central-eastern China as defined here.
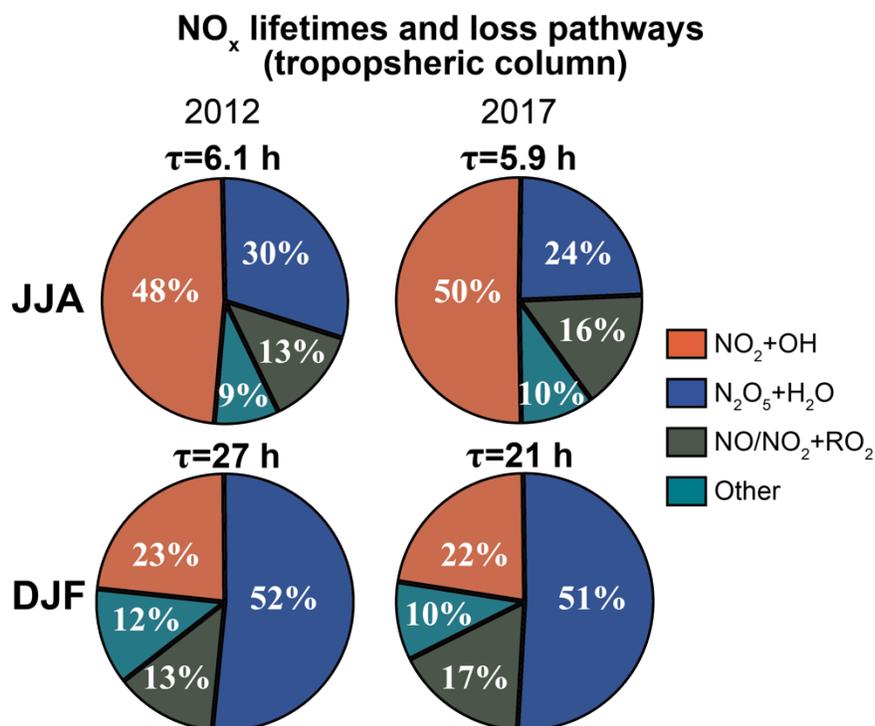
NO$_x$ lifetimes and loss pathways (tropospheric column)

2012 — τ=6.1 h
2017 — τ=5.9 h
JJA

2012: 30%, 48%, 13%, 9%
2017: 24%, 50%, 16%, 10%

τ=27 h
τ=21 h
DJF

2012: 23%, 52%, 12%, 13%
2017: 22%, 51%, 10%, 17%

Legend:
- NO$_2$+OH
- N$_2$O$_5$+H$_2$O
- NO/NO$_2$+RO$_2$
- Other

Figure S2: NO$_x$ lifetime (τ) and loss pathways for the tropospheric column over central-eastern China. The lifetimes are the GEOS-Chem averages for the tropospheric column weighted by the OMI averaging kernel over the domain delineated in Figure 1, and the pie charts show the relative contributions of the different NO$_x$ sinks. For the lifetime calculation we define NO$_x$ as NO+NO$_2$+NO$_3$+2N$_2$O$_5$+HONO+HNO$_4$+ ClNO$_2$. Values are given for summer (JJA) and winter (DJF) of 2012 and 2017. The sink from NO/NO$_2$ + RO$_2$ is the net flux, accounting for partial recycling of the organic nitrates, and includes the contributions from peroxyacyl nitrates (PANs). The 'Other' sinks include NO$_3$ + VOC reactions, NO$_2$ and NO$_3$ hydrolysis in aerosols, and NO$_x$ deposition.
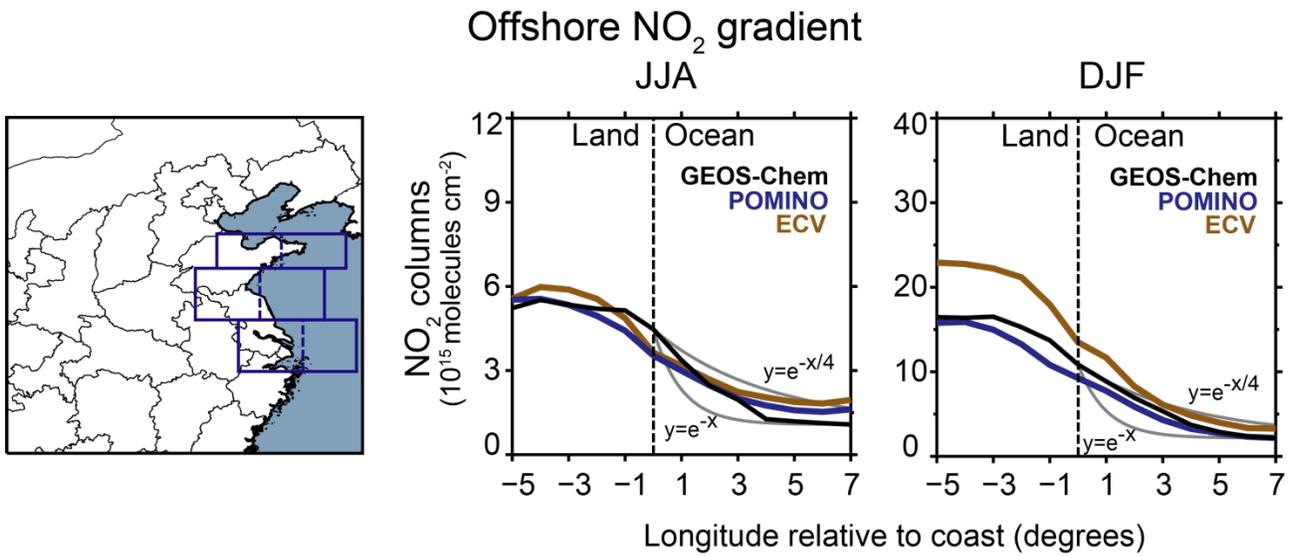
Offshore NO$_2$ gradient

Figure S3: Offshore gradient of NO$_2$. The right panels show the seasonal-mean longitudinal gradient of OMI and GEOS-Chem columns across China's eastern coast averaged over the latitudinal sections marked in the left panel. The dashed lines indicate approximate land-ocean boundaries. The decay curves corresponding to e-folding lengths of 1° and 4° longitude are also shown.
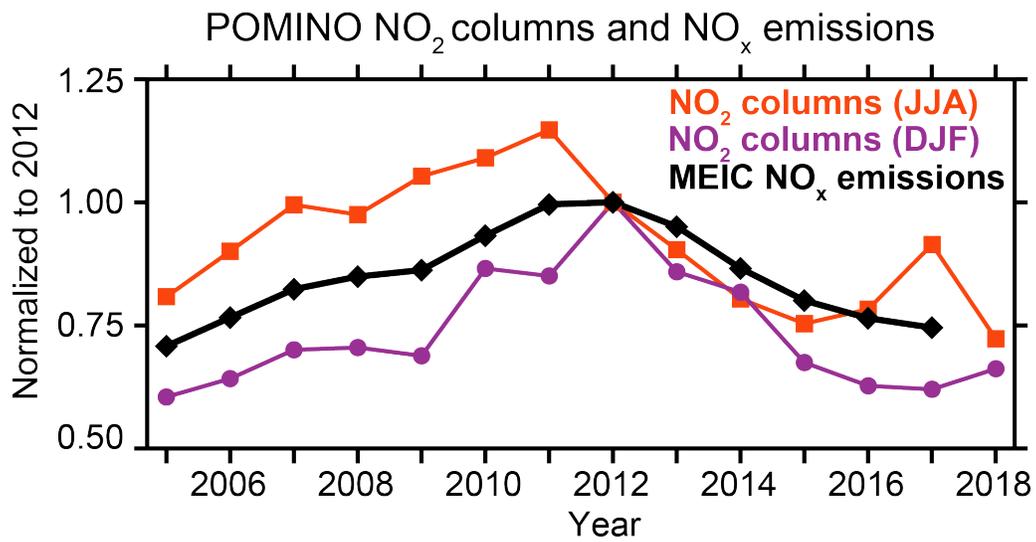
Figure S4: Trends in POMINO NO₂ columns over central-eastern China. The figure shows the trends in the POMINO tropospheric NO_2 columns (Liu et al., 2019) and the MEIC NO_x emissions (Zheng et al., 2018) over central-eastern China (region delimited in Fig. S1). Values are 3-month means for June, July, and August (JJA) and December, January, and February (DJF) normalized to 2012 (JJA) and 2011/12 (DJF).