*Supplementary information for*

# An investigation into atmospheric nitrous acid (HONO)

# processes in South Korea

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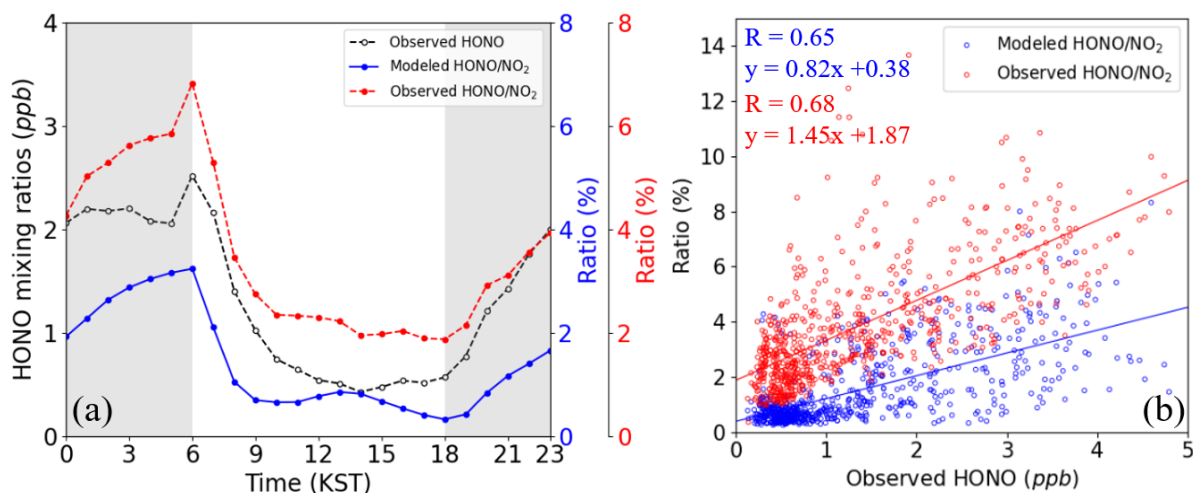
**Fig. S1.** (a) Diurnal variations of observed HONO (black open circles, left y-axis), modeled HONO to $NO_2$ ratio (blue line, right y-axis), and observed HONO to $NO_2$ ratio (red line, right y-axis) and (b) their scatter-plots between the observed HONO and the modeled ratio of HONO to $NO_2$ (blue circles), and observed HONO to $NO_2$ (red circles) at the Olympic Park station during the period of the KORUS-AQ campaign.
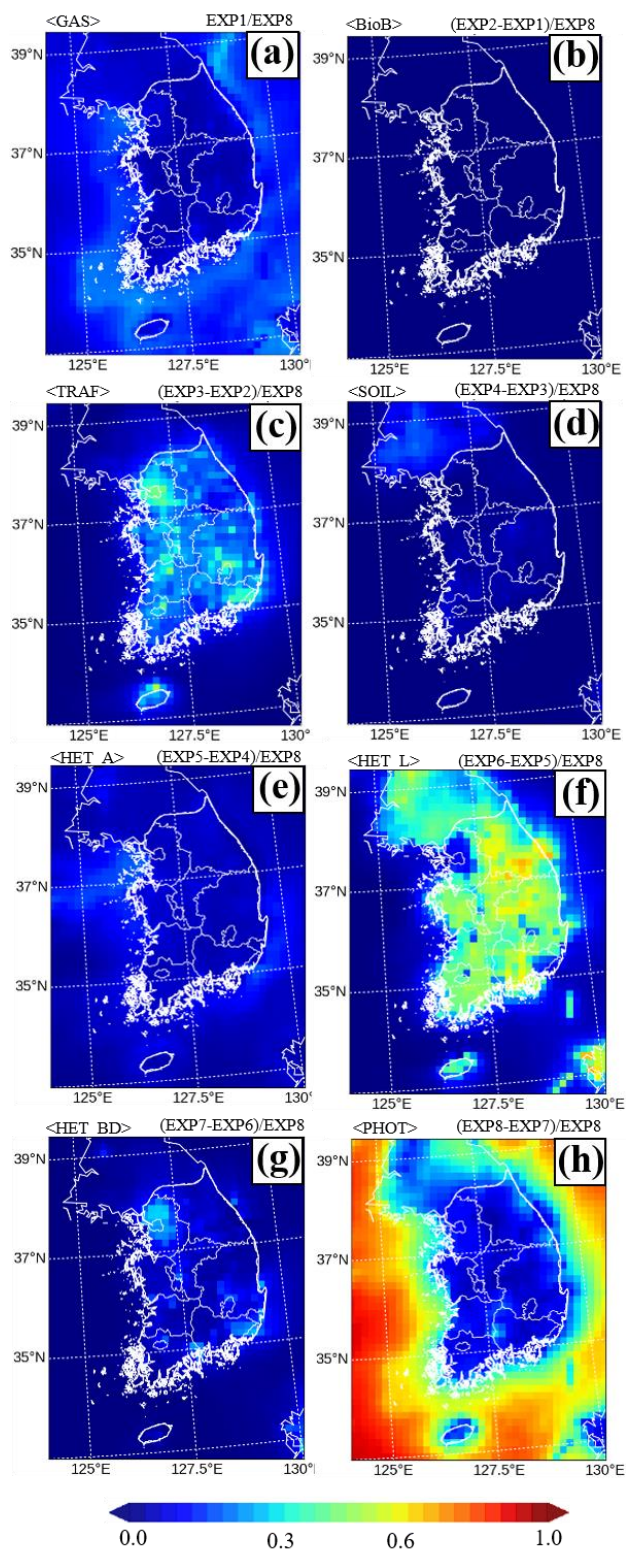
**Fig. S2.** Incremental ratio of (a) gas phase reactions; (b) biomass burning emissions; (c) traffic emissions and (d) soil emissions; (e) heterogeneous reactions on the aerosol surfaces, (f) heterogeneous reactions on the leaf surfaces, and (g) heterogeneous reactions on the building surfaces; and (h) renoxification on HONO mixing ratios (unit: dimensionless).

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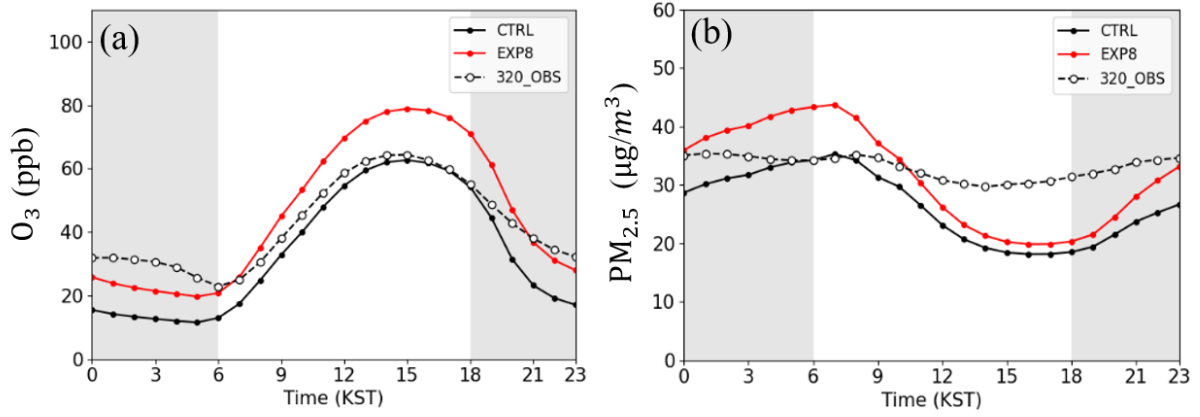
**Fig. S4.** Comparison of diurnal variations of the mixing ratios of (a) $O_3$, and (b) $PM_{2.5}$. Both are averaged for 320 AIR KOREA monitoring stations during the period of the KORUS-AQ campaign. The black open circles, black lines, and red lines represent observed values and values from the CTRL and EXP8 simulations, respectively.
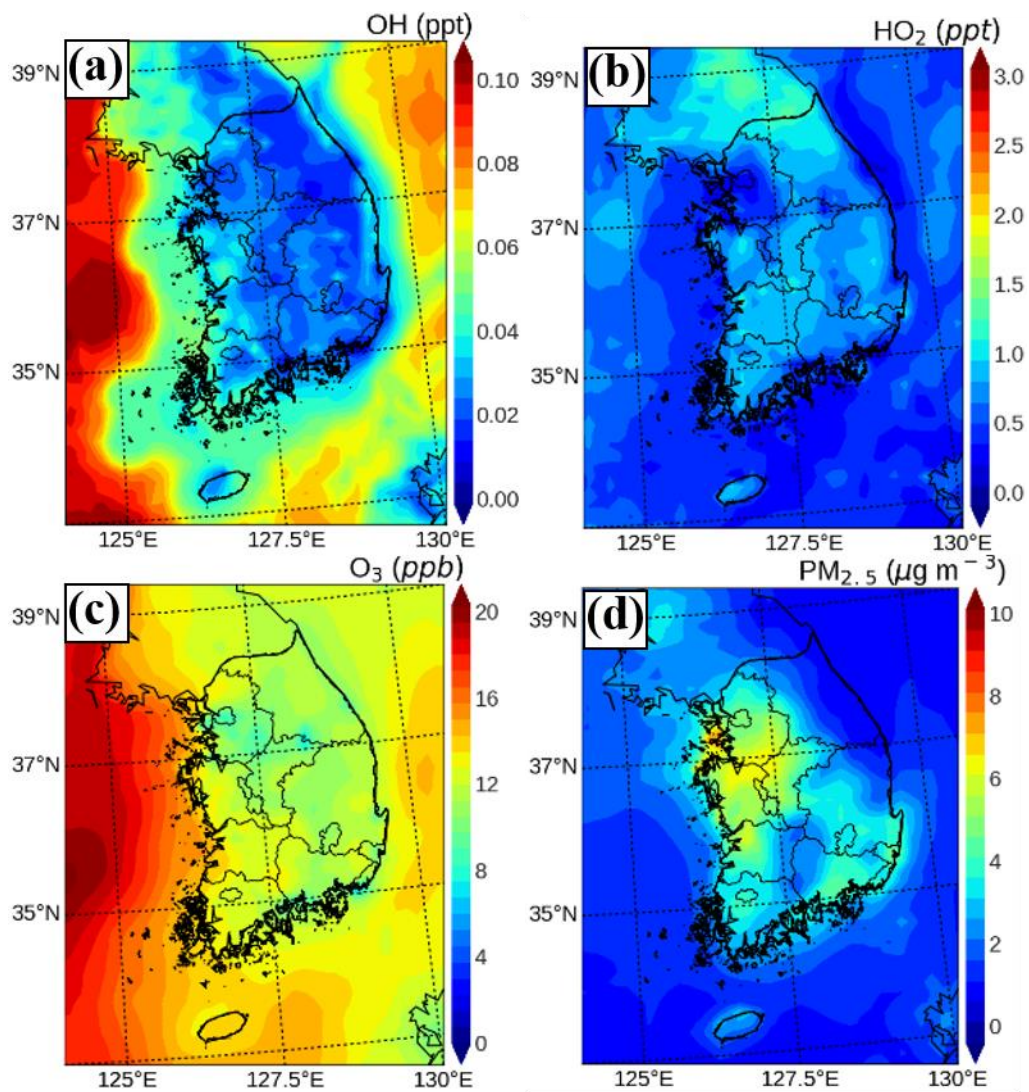
**Fig. S5.** Spatial distributions of the differences levels of (a) HONO, (b) OH, (c) HO$_2$, and (d) PM$_{2.5}$ between the EXP8 and CTRL simulations in South Korea during the period of the KORUS-AQ campaign.

41   **Table S1.** Detection limits and uncertainties of instruments for observed HONO, $NO_2$, $O_3$, and
42   $PM_{2.5}$ at Olympic Park station, Korea.

| Species | Instruments | Detection limit | Uncertainty | Time resolution |
|---|---|---|---|---|
| HONO | Monitor for Aerosols and Gases in Ambient Air (MARGA, model ADI 2080) | 0.02ppbv | ±20% | 1 hour |
| $NO_2$ | Ecotech gas sensor, EC8941 | 0.5ppbv | ±10% | 1 hour |
| $O_3$ | Ecotech gas sensor, EC9810 | 0.5ppbv | ±5% | 1 hour |
| $PM_{2.5}$ | Thermo Fisher Scientific, FH62C14 | $4\mu g/m^3$ | ±10% | 1 hour |

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44 **Table S2**. Statistical analysis of modeled and observed meteorological parameters at the
45 Olympic Park station during the period of the KORUS-AQ campaign.

| Parameter | Observed mean | Modeled mean | R | RMSE | MB | IOA |
|---|---|---|---|---|---|---|
| RH (%) | 55.50 | 55.60 | 0.87 | 11.06 | 0.09 | 0.93 |
| T (℃ ) | 22.38 | 21.10 | 0.94 | 1.84 | -1.28 | 0.94 |
| Pressure (hPa) | 1000.35 | 999.75 | 0.97 | 1.14 | -0.60 | 0.98 |
| WS (m s$^{-1}$) | 2.08 | 2.46 | 0.45 | 1.17 | 0.39 | 0.65 |
| WD (°) | 205.40 | 202.18 | 0.53 | 83.49 | -3.24 | 0.74 |

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