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Supplement of

Influence of photochemical loss of volatile organic compounds on understanding ozone formation mechanism

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Supporting information

Figure S1. Location of the observation station (Zhan et al., 2021). The map is originated from © Google Maps.
Figure S2. The comparison of toluene from SPIMS and GC/FID.
Figure S3. The mean diurnal curve of $J_{NO2}$. 
Figure S4. The relationship between the concentration of ethylbenzene and xylene.
**Figure S5.** Comparison of PICs calculated for xylene/ethylbenzene and i-Butene/Propene (Zhan et al., 2021). Error bars are standard deviations.
Figure S6. The relationship between the concentration of toluene vs acetylene and n-hexane vs toluene.
Figure S7. The potential source contribution function (PSCF) maps for the ratio of xylene to ethylbenzene (a and b), ethylbenzene (c and d), and xylene (e and f) arriving in the observation site. The figures of a, c and e are the results of 05:00 and 06:00, and the figures of b, d and f are the results during the daytime (07:00-19:00).
**Figure S8.** The mean diurnal curves of the concentration of xylene and ethylbenzene, their ratio, the OH exposure concentration (molecule cm$^{-3}$) and solar zenith angle.
Figure S9. The average diurnal variation of isoprene emission.

The volume concentration of isoprene is calculated based on daily emission curve using the Eq. S1,

\[ C_{\text{isoprene}} = \frac{\text{Emi}}{\text{Day} \times S \times H} \times \frac{RT}{PM} \] (S1)

where Emi is the emission flux; Day, S and H are the total days of a year, the core urban area of Beijing, and the boundary layer height (~500 m, median of mean diurnal variation), respectively; R, T, P and M are the ideal gas constant, temperature, pressure and the molar molecule mass of isoprene).
Figure S10. The time series of observed and simulated O$_3$. 
Figure S11. The relationship between observed and simulated O₃.
**Figure S12.** The average diurnal variation of F(O₃).
Figure S13. The wind direction at the observation site on 4th Aug (a, backward and forward meaning upwind and downwind, respectively) and the diurnal variation of ozone concentration at observation site (OS) and one downwind site (national monitoring station (NMS)).
Figure S14. The percentages of different ozone production and loss rate (observed VOCs in a and c, and PIC-VOCs in b and d). The upper and lower panels present the percentages of different ozone production and loss rate, respectively.
Figure S15. The mean diurnal curves of xylene, ethylbenzene and isoprene.
Figure S16. The potential source contribution function (PSCF) maps for the isoprene arriving in the observation site. The figures of a and b are the results of 05:00 and 06:00, and the daytime (07:00-19:00), respectively.

Isoprene is mainly from biogenic emissions but not co-located with the aromatic emission sources in summer, which is evidenced by the diurnal variations of isoprene, xylene and ethylbenzene (Figure S15) although the regional model emissions for isoprene are unavailable at the present time. The results of PSCF analysis showed that the spatial pattern of isoprene is even during our observations in Figure S16, which indirectly indicated that it could be considered as the balance on production and loss of isoprene along the transport, and the concentration of isoprene remain constant in the trajectory from the aromatic source region to the site.
Table S1. Measured parameters for the observation-based model.

| Parameters               | Measurement Technique               | Time Resolution |
|--------------------------|-------------------------------------|-----------------|
| $\text{J}_{\text{NO}_2}$ | $\text{J}_{\text{NO}_2}$ radiometer, Metcon | 20 s            |
| $\text{O}_3$, $\text{NO}_x$, $\text{SO}_2$, CO | 42i, 43i, 48i, and 49i, Thermal Scientific | 60 s            |
| HONO                     | LOPAP, ICCAS                        | 60 s            |
| Meteorological parameters | AWS310, Vaisala                      | 60 s            |
| NMHCs                    | GC-FID, RCEES                        | 1 h             |
| Halohydrocarbon          | SPIMS., Hexin Instrument Co., Ltd    | 1 h             |
| OVOC                     | HPLC, GL Sciences                    | 2 h             |