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A large role of missing volatile organic compound reactivity from anthropogenic emissions in ozone pollution regulation

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S1 The correction of NO interference on R_{OH} measurements

The NO-correction experiments were conducted by introducing given amounts of VOC standard gases into the reactor. Different levels of NO were injected into the reactor and the difference between "measured" R_{OH} and true R_{OH} increased as the NO concentration increased. Here, the difference between "measured" R_{OH} and true R_{OH} is defined as δR_{OH}. Then, a correction curve was fitted between the δR_{OH} and NO concentrations. Several standard gases (propene and PAMS mixture) and different levels of base reactivity (from 30 to 90 s^{-1}) have been tried and the curve was quite consistent for all tested gases, as shown in Fig. S1. According to this correction curve and ambient NO concentrations, we calculated the δR_{OH} which was used to correct the measured R_{OH}.

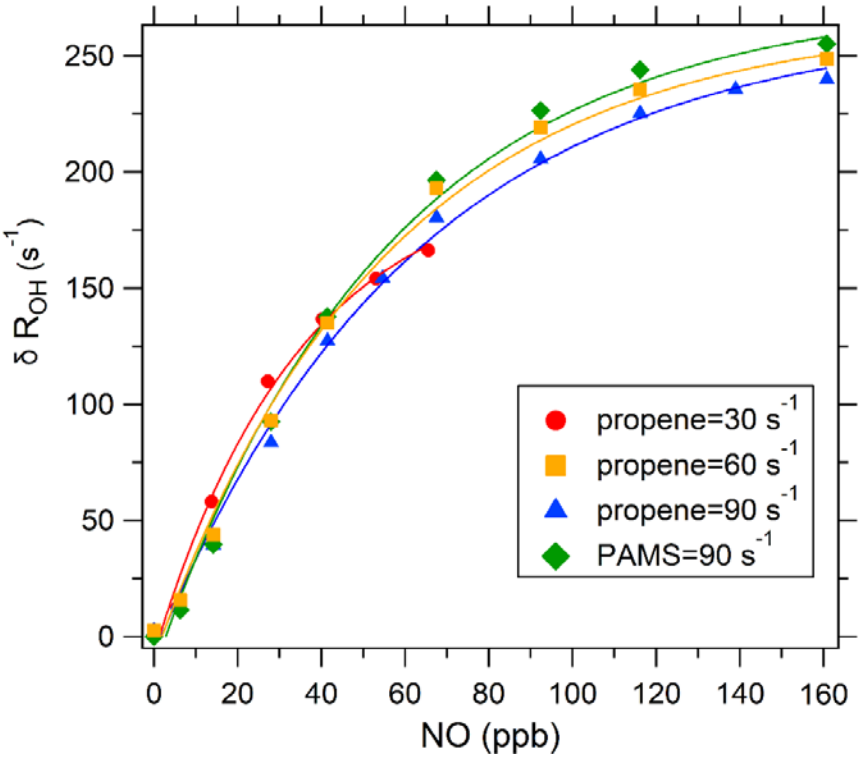

Figure S1. NO-correction experiments and fitting curves in Guangzhou in 2018 at different R_{OH} of propene standard gas and mixture standard gas. The mixture standard gas used is the mixture PAMS (photochemical assessment monitoring stations) of 56 non-methane hydrocarbons (NMHCs; SpecialGas Ltd, USA).

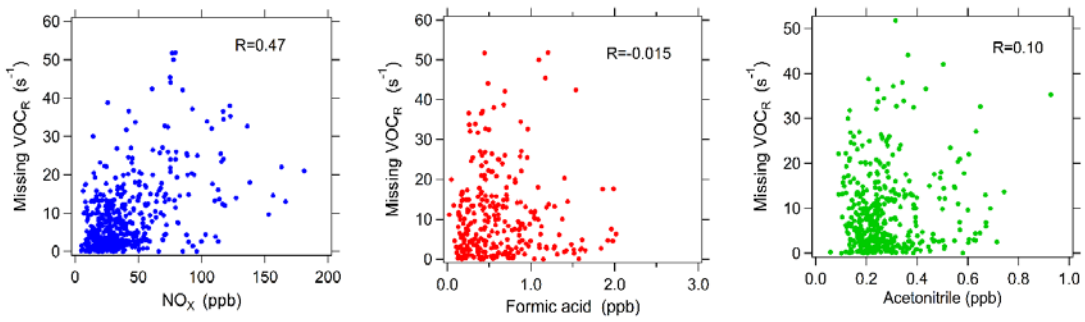

Figure S2. Correlation of missing VOC_R with NO_X, formic acid (HCOOH) and acetonitrile during the measurement in Guangzhou. Each point represents hourly data.

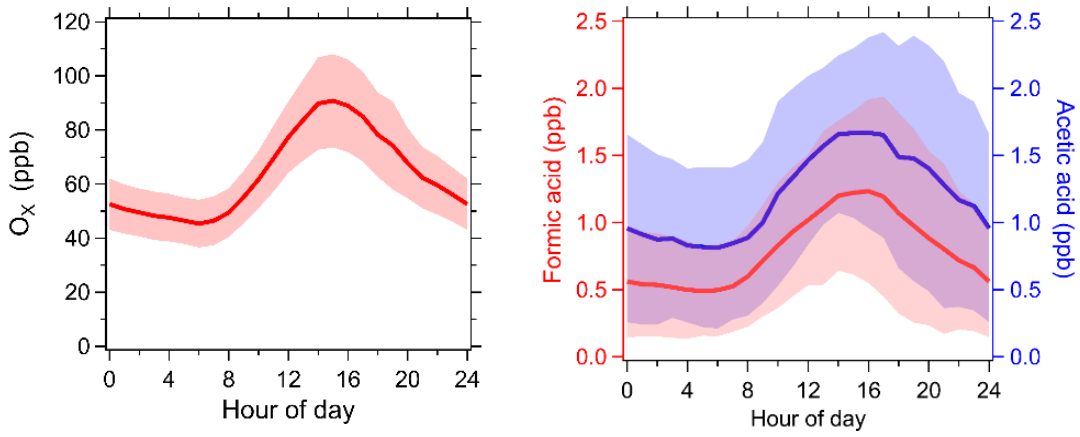

Figure S3. Diurnal variations in O_X, formic acid and acetic acid.

47 **Table S1. VOC species measured in this study**

Classes	VOC species
Alkane	ethane, propane, isobutane, n-butane, cyclopentane, isopentane, n-pentane, 2,2-dimethylbutane, 2,3-dimethylbutane, 2-methylpentane, 3-methylpentane, n-hexane, 2,4-dimethylpentane, methylcyclopentane, 2-methylhexane, cyclohexane, 2,3-dimethylpentane, 3-Methylhexane, 2,2,4-trimethylpentane, n-heptane, methylcyclohexane, 2,3,4-trimethylpentane, 2-methylheptane, 3-methyl Heptane, octane, n-nonane, n-decane, n-undecane, n-dodecane
Alkene	ethylene, propylene, trans-2-butene, 1-butene, cis-2-butene, 1,3-butadiene, 1-pentene, trans-2-pentene, isoprene, cis- 2-pentene, 1-hexene
Aromatic	benzene, ethylbenzene, m/p-xylene, o-xylene, styrene, n-propylbenzene, 3-ethyltoluene, 4-ethyltoluene, 1,3,5-trimethyl Benzene, 2-ethyltoluene, 1,2,4-trimethylbenzene, 1,2,3-trimethylbenzene, 1,3-diethylbenzene, 1,4-diethylbenzene, toluene

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Table S2. The 31 VOCs which were calibrated using either gas or liquid standards. The ion formula of these VOCs detected by PTR-ToF-MS and corresponding sensitivity are provided.

VOC species	Ion formula	Sensitivity, cps/ppb
Formaldehyde	CH_2OH^+	1042
Methanol	CH_4OH^+	629.3
Acetonitrile	$C_2H_3NH^+$	3374
Acetaldehyde	$C_2H_4OH^+$	2767
Ethanol	$C_2H_6OH^+$	99.23
Acrolein	$C_3H_4OH^+$	4107
Acetone	$C_3H_6OH^+$	4299
Furan	$C_4H_4OH^+$	2544
Isoprene	$C_5H_8H^+$	1888
MVK+MACR	$C_4H_6OH^+$	3868
MEK	$C_4H_8OH^+$	4467
Benzene	$C_6H_6H^+$	3151
2-Pentanone	$C_5H_{10}OH^+$	4510
Toluene	$C_7H_8H^+$	3978
Phenol	$C_6H_6OH^+$	4076
Furfural	$C_5H_4O_2H^+$	7460
Methyl Isobutyl Ketone	$C_6H_{12}OH^+$	3988
Styrene	$C_8H_8H^+$	4289
xylene	$C_8H_{10}H^+$	4241
Cresol	$C_7H_8OH^+$	4299
Trimethylbenzene	$C_9H_{12}H^+$	4413
Naphthalene	$C_{10}H_8H^+$	5117
a-Pinene	$C_{10}H_{16}H^+$	2332
Formic acid	$CH_2O_2H^+$	856.6
Acetic acid	$C_2H_4O_2H^+$	1711
Propionic acid	$C_3H_6O_2H^+$	2072
Butyric acid	$C_4H_8O_2H^+$	2358
Pyrrole	$C_4H_5NH^+$	2842
Formamide	CH_3NOH^+	2871
Acetamide	$C_2H_5NOH^+$	3992

Table S3. The units of variables used in this study.

Variables	Units
R_{OH}	s^{-1}
k_{OH+Xi}	$ppb^{-1}\ s^{-1}$
$[X_i]$	ppb
VOC_R	s^{-1}
$Missing\ VOC_R$	s^{-1}
$C_{backgound}$	s^{-1}
$P(O_3)$	$ppb\ h^{-1}$
$L(O_3)$	$ppb\ h^{-1}$
$j(O^1D)$	s^{-1}
L_N/Q	unitless