A high resolution Volatile Organic Compounds Emission from gas station and its effect on ozone concentration: take Xi'an for example

Mengfei Lv, Qizhong Wu Email: wqizhong@bnu.edu.cn

College of Global Change and Earth System Science , Beijing Normal University , China

Introduction

The contribution of volatile organic compounds (VOC) to ozone continues to receive attention and various localities have successively introduced measures to control VOC including limiting emissions from gas stations.

Xi'an, as a major city of Fenwei Plain, has a large number of motor vehicles and a large demand for gasoline. The VOC emission from gas stations can not be ignored in the city.

Data and Method

1. Meteorological field provided by WRF

Initial field and boundary conditions 1°×1°, 6h

2. Emission inventory provided by SMOKE

Regional background emission inventory in East Asia,
Local emission inventory of Guanzhong Plain,
VOC emission inventory of Xi'an gas station.

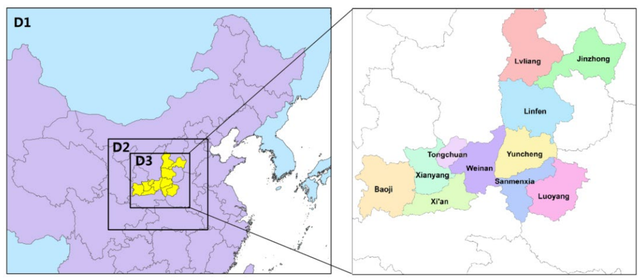

Fig 1. The schematic diagram of three layer nested region

Species name	Allocation rate
ALDX	0.018
FORM	0.001
IOLE	0.008
ISOP	0
NR	0.033
OLE	0.009
PAR	0.361
TOL	0.231
XYL	0.338

Table 1. Apportionment rate of each species in SMOKE

Results and Discussion

·Emission activity level of this study adopts the gasoline consumption of transportation industry.

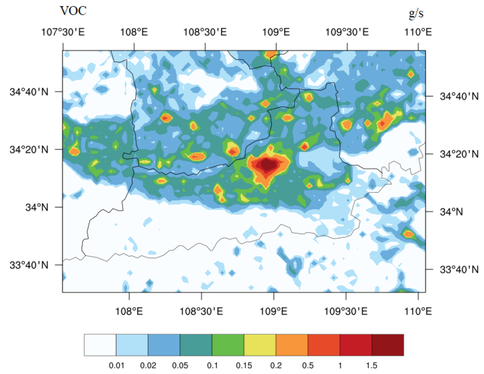

Fig 2. The VOC emission spatial distribution map in Xi'an

·Put the basic emission list (base) and the localized emission list (add VOC) into the CAMx mode system respectively to compare the impact effects of O_3 and SOA.

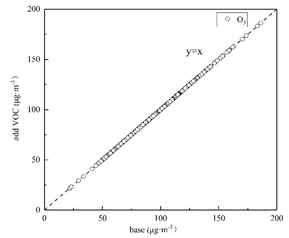

Fig 3. The scatter plot of O_3 concentration of base and add VOC

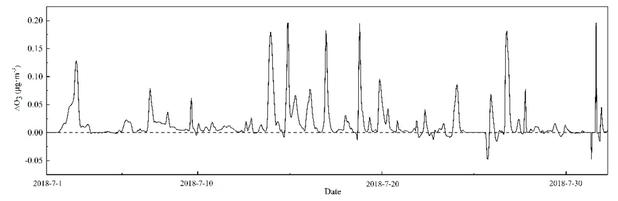

Fig 4. The time series of $\triangle O_3$ concentration (units: μg/m^3)

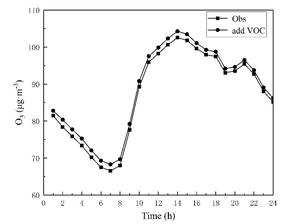

Fig 5. The daily variation curve of O_3 in Xi'an on July 2018

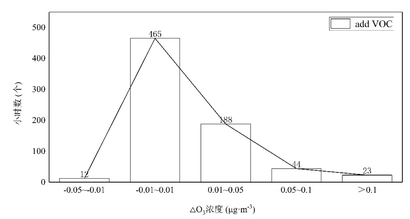

Fig 6. The segmented statistical chart of $\triangle O_3$ concentration

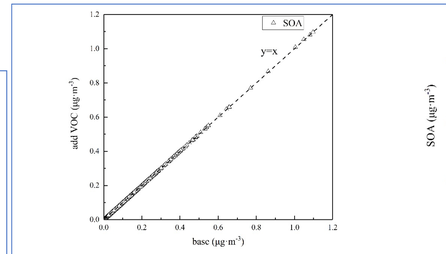

Fig 7. Scatter plot of SOA concentration of base and add VOC

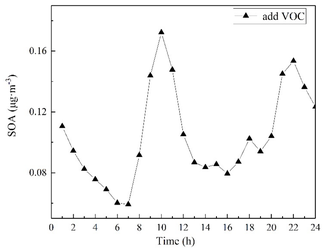

Fig 9. The daily change curve of SOA

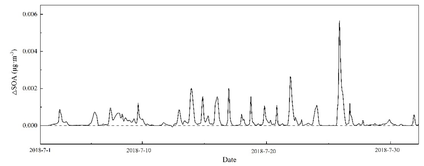

Fig 8. The time series of △SOA concentration (units: μg/m^3)

Conclusions

After considering the VOC emissions from gas stations, the concentrations of ozone (O_3) and secondary organic aerosol (SOA) simulated by the sensitivity test in July 2018 were slightly higher than that results without the gas stations VOC emissions.

The daily change of O_3 in July 2018 simulated by the control test considering gas stations VOC emissions shows a unimodal distribution.

The results of sensitivity numerical test show that the gas stations VOC emissions in Xi'an just has a little influence on air quality.

References

Lv M F, Wu Q Z, Yang X C ,et al. 2021. Numerical Simulation Study on Volatile Organic Compounds Emissions and Its Effects from Gas Stations in Xi'an [J]. Acta Scientiae Circumstantiae

Wu Q Z，Xu W S，Shi A，et al．2014．The air quality forecast in Beijing with Community Multiscale Air Quality Modeling（CMAQ）System：Modelevaluation and improvement[J]．Geoscientific Model Development，7（5）:2243-2259

Shen, Hao, Wang. 2006. Current situation and control of VOC emission pollution from gas stations in China [J]. Environmental science, 27 (8): 1473-1478

Yang X C，Wu Q Z，Zhao R，et al．2019．New method for evaluating winter air quality：PM2.5 assessment using Community Multi-Scale Air Quality Modeling（CMAQ）in Xi'an[J]．Atmospheric Environment，211：18-28

Yang X C，Xiao H，Wu Q Z,et al. 2020. Numerical study of air pollution over a typical basin topography：Source appointment of fine particulate matter during one severe haze in the megacity Xi'an[J]．Science of the Total EnvironMent ,708：135213