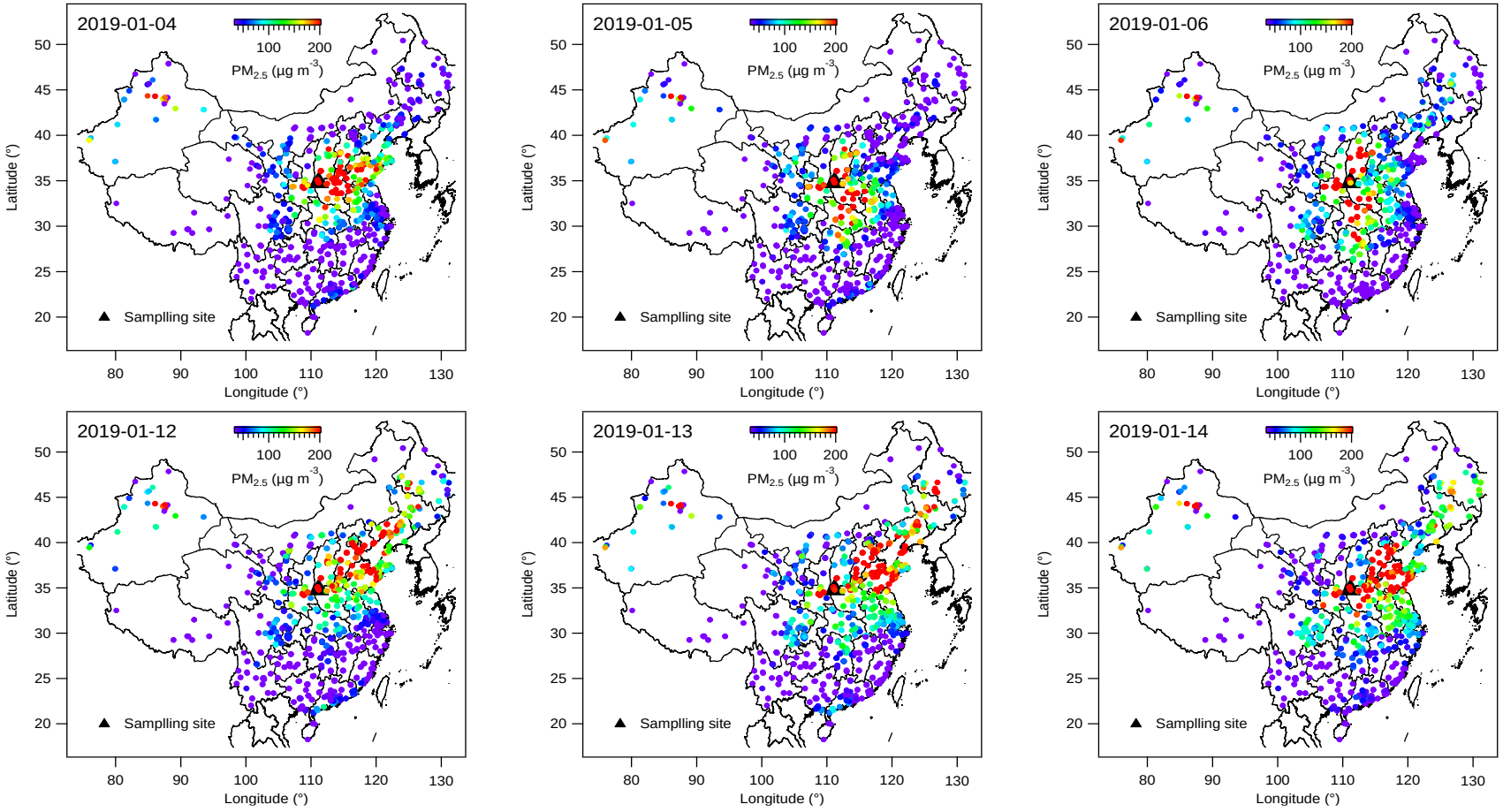
Characterization of aerosol composition and sources in a polluted city in Central China

Qingqing Wang [a, b*], Jie Li [a, b*], Jinxing Yang [c], Yong Chen [a, b], Yanyu Li [a, b], Shiyao Li [d], Conghui Xie [a, b], Chun Chen [a, b], Lingling Wang [e], Lin Wang [c], Weigang Wang [f], Shengrui Tong [f], Yele Sun [a, b, g]

[a] State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, IAP, CAS, Beijing 100029, China
[b] University of Chinese Academy of Sciences, Beijing 100049, China
[c] Sanmenxia Environmental Monitoring Station, Sanmenxia 472400, China
[d] 3 Clear Technology Co., Ltd, Beijing 100029, China
[e] Henan environmental monitoring center station， Zhengzhou 450000, China
[f] State Key Laboratory for Structural Chemistry of Unstable and Stable Species, Beijing National Laboratory for Molecular Sciences (BNLMS), CAS Research/Education Center for Excellence in Molecular Sciences, ICCAS, Beijing 100190, China
[g] Center for Excellence in Regional Atmospheric Environment, IUECAS, Xiamen 361021, China

Corresponce to : Qingqing Wang (wangqingqing@mail.iap.ac.cn), Jie Li (lijie8074@mail.iap.ac.cn)

Background: Spatial maps of $PM_{2.5}$ mass concentration in China during a haze episode

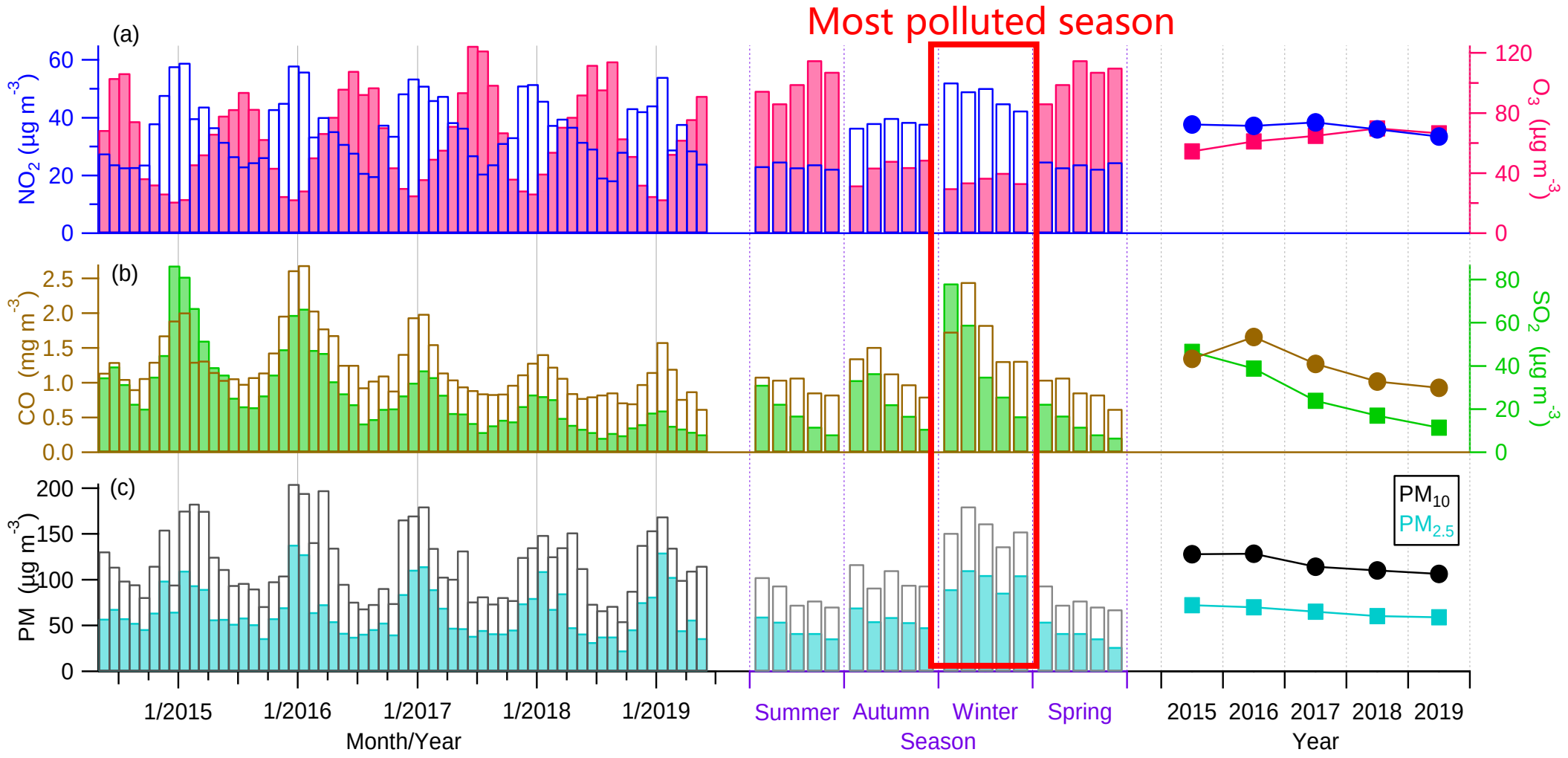


▲ Sanmenxia

The studied site.

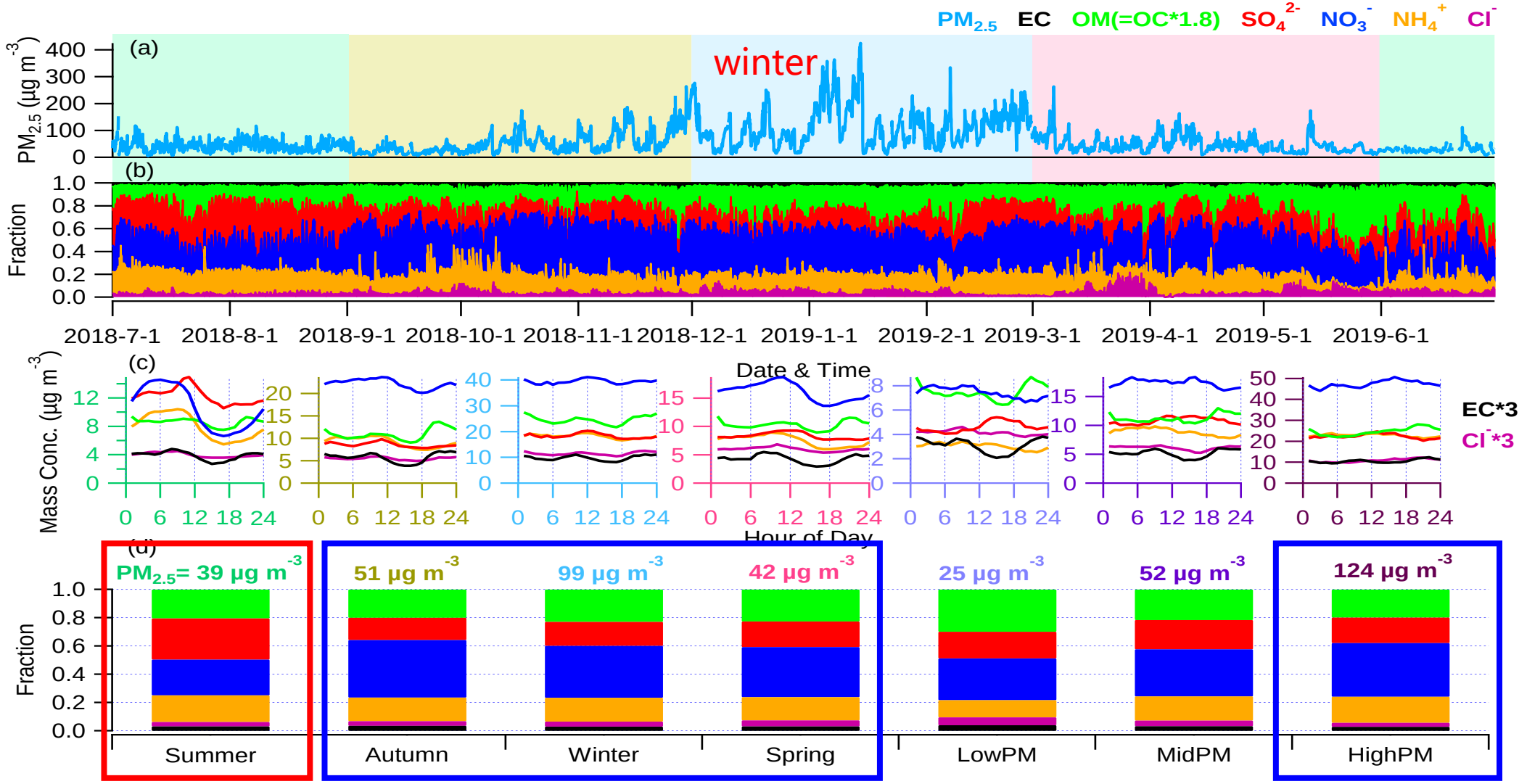
Sanmenxia, a highly polluted city nearby the gorge of the Yellow River in Central China, is located at the junction of the three provinces of Henan, Shanxi, and Shaanxi, which is the so-called "Golden Triangle Area" of the region south of the Yellow River.

Results: Temporal variation of air pollutants in 5 years



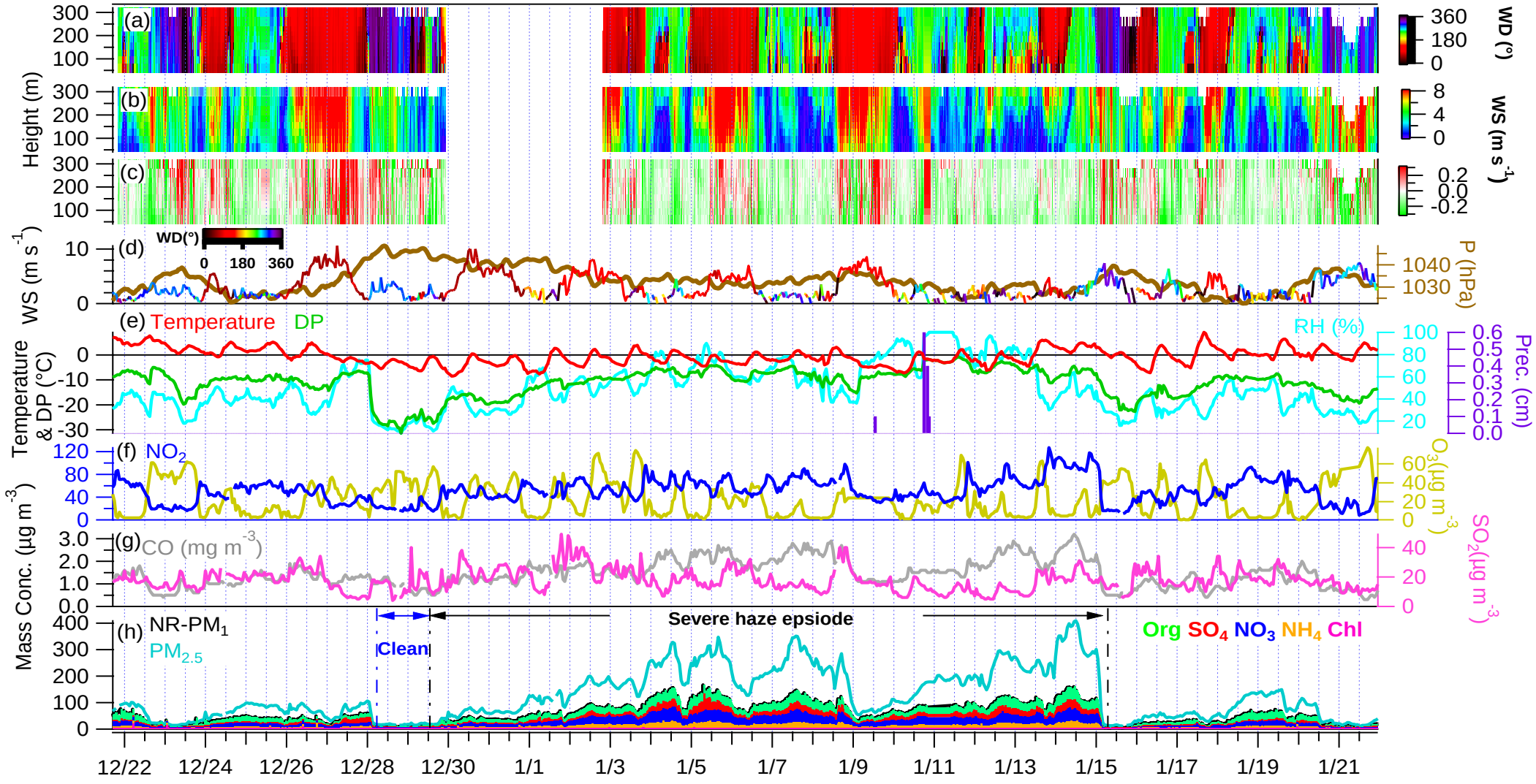
PM, NO_2, SO_2, and CO gradually decreased due to emission control since 2015, and were all at the highest level in winter. However, O_3 has continued to increase.

Variation of $PM_{2.5}$ and $PM_{2.5}$ species in one year



Significant contribution of nitrate in Sanmenxia.

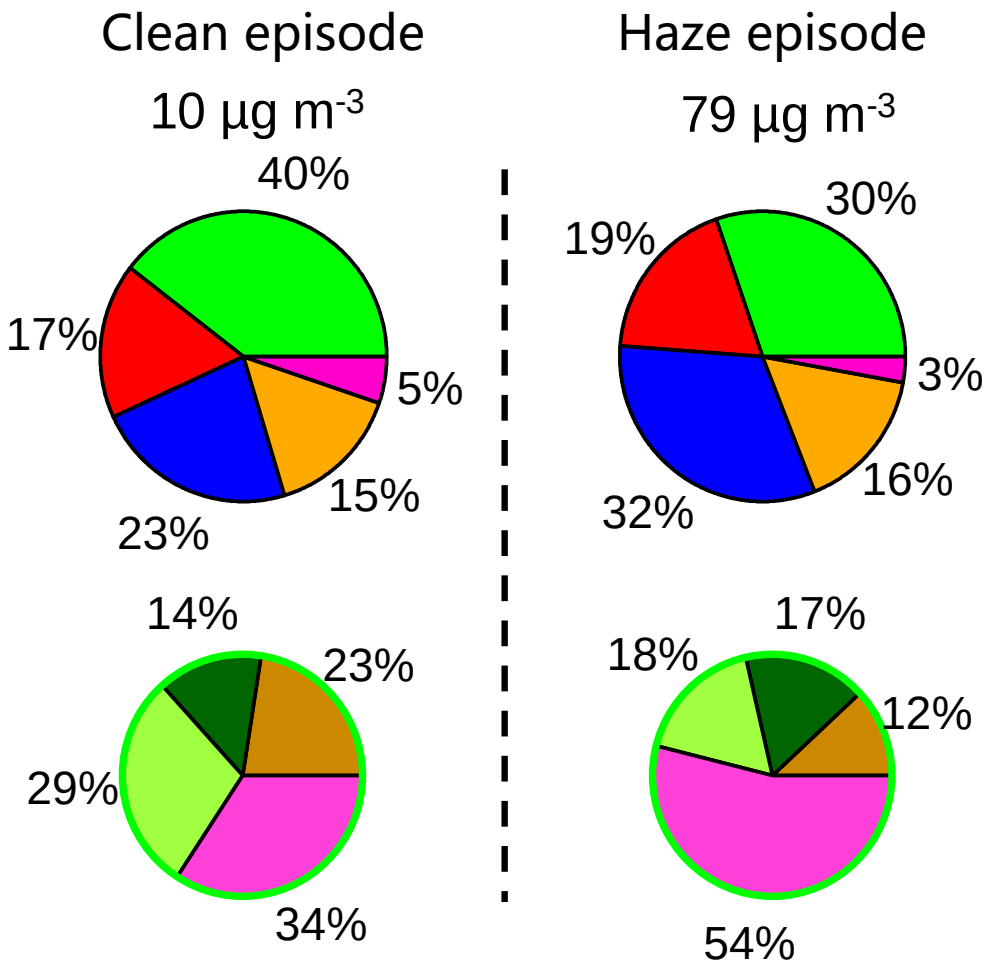
Enhanced observation in winter



A strong haze event lasted for about 16 days.

The average NR-PM_1 and $PM_{2.5}$ concentrations were 79 μg m^{-3} and 181 μg m^{-3}, respectively.

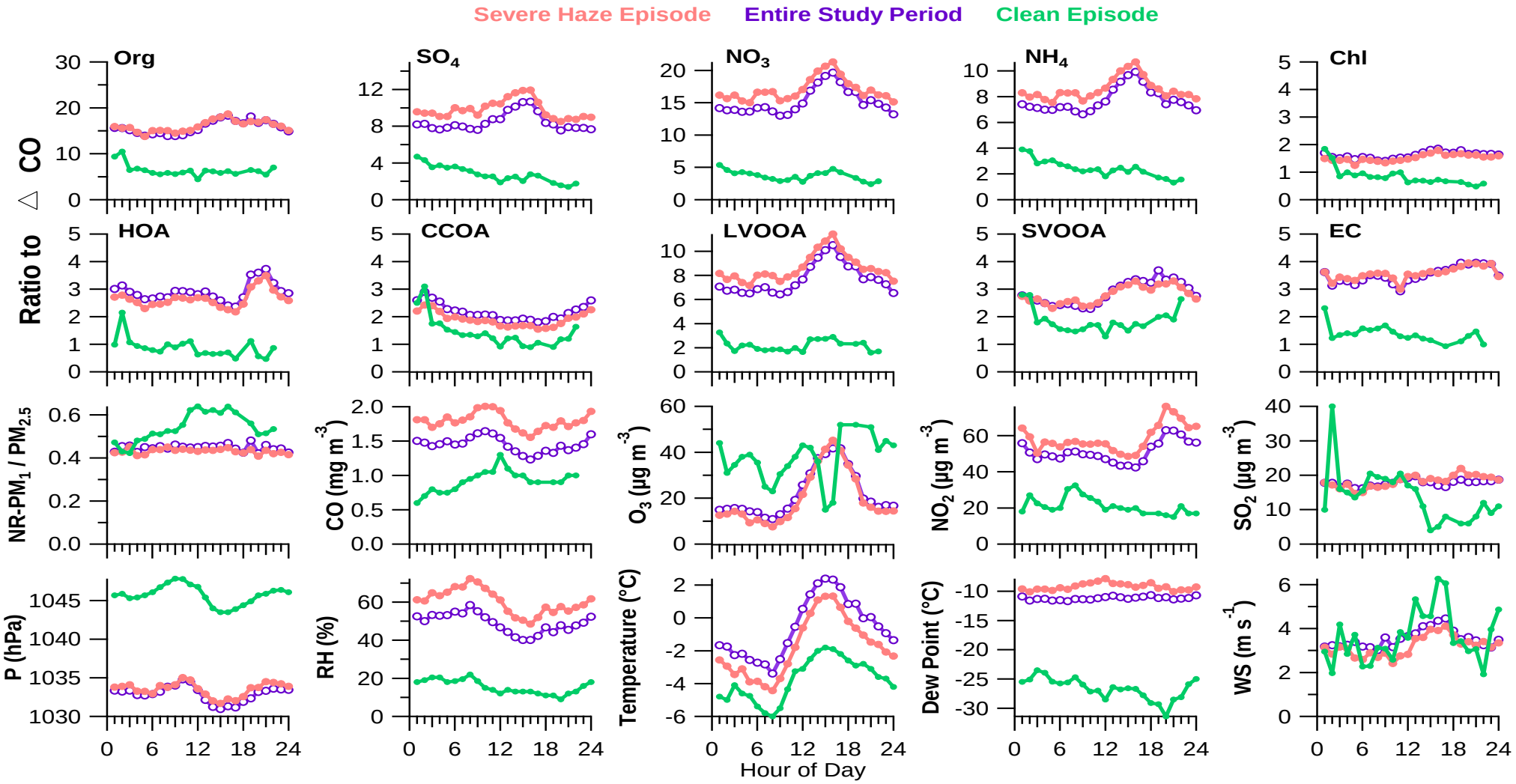
Chemical composition and organic sources of NR-PM_1



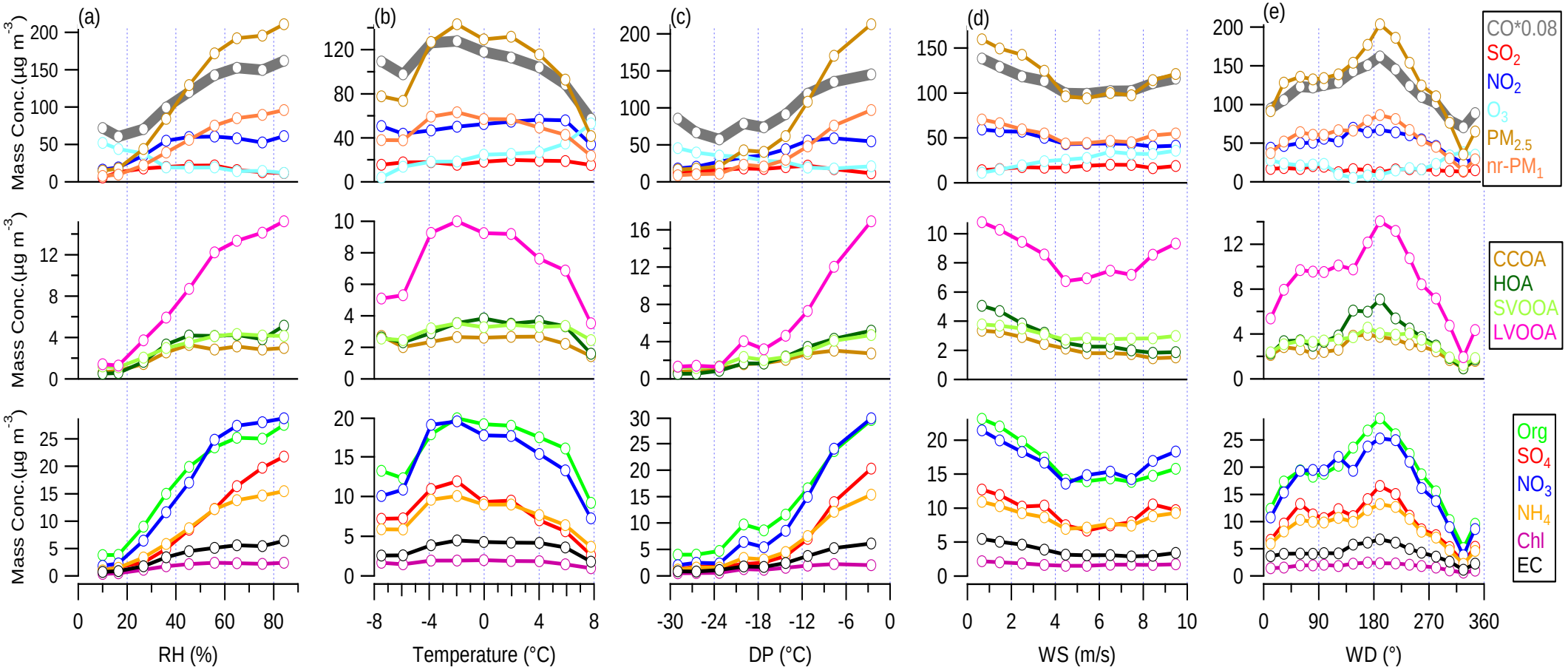
NR-PM_1(non-refractory PM_1) sampled by ACSM.

HOA : Hydrocarbon-like organic aerosol; CCOA : coal combustion OA; SVOOA : semi-volatile oxygenated OA; LVOOA : low-volatility oxygenated OA.

Diurnal variations

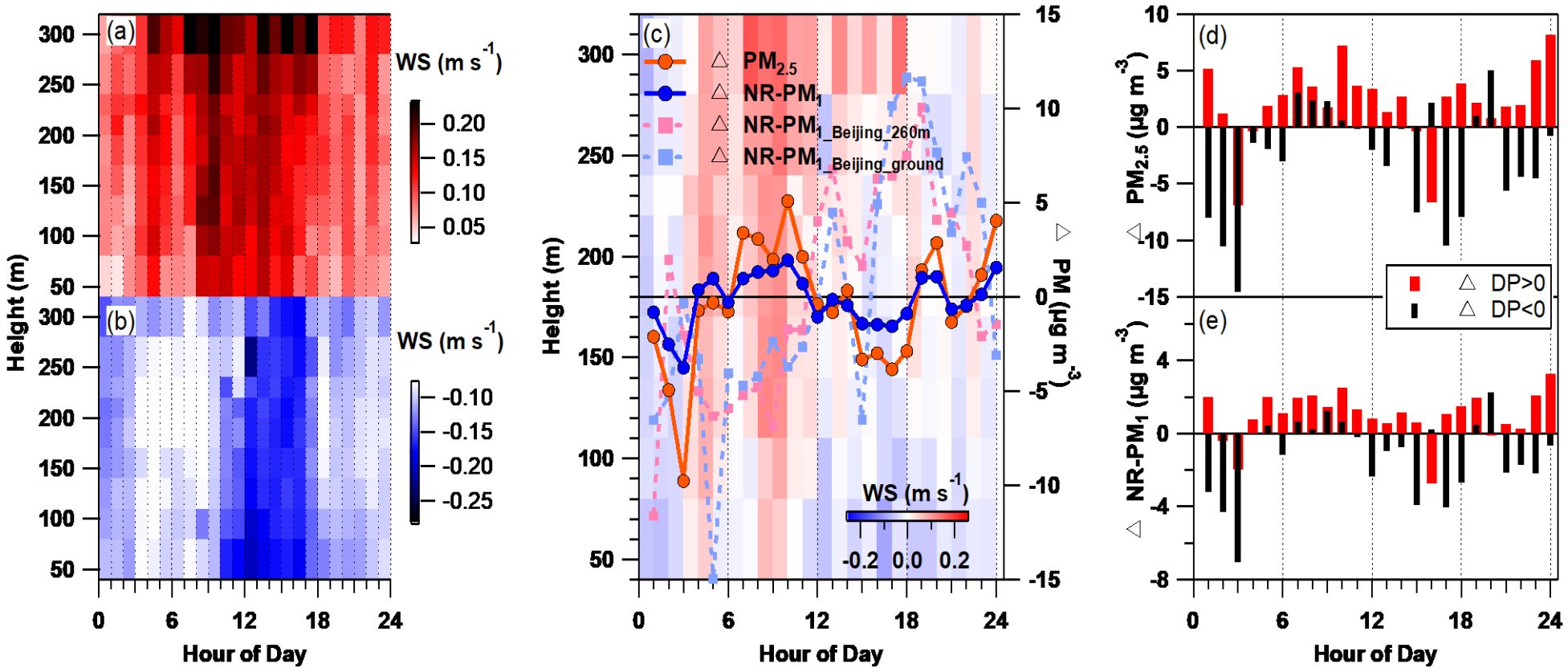


Variations of pollutants as functions of meteorological variables



DP and WD are important for heavy pollution.

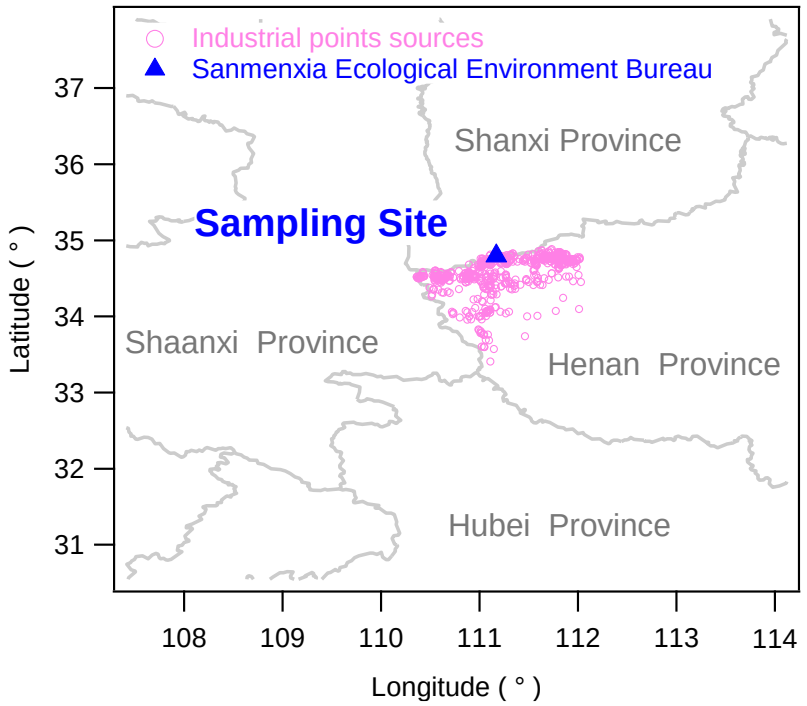
Effect of downdraft on morning increase in PM



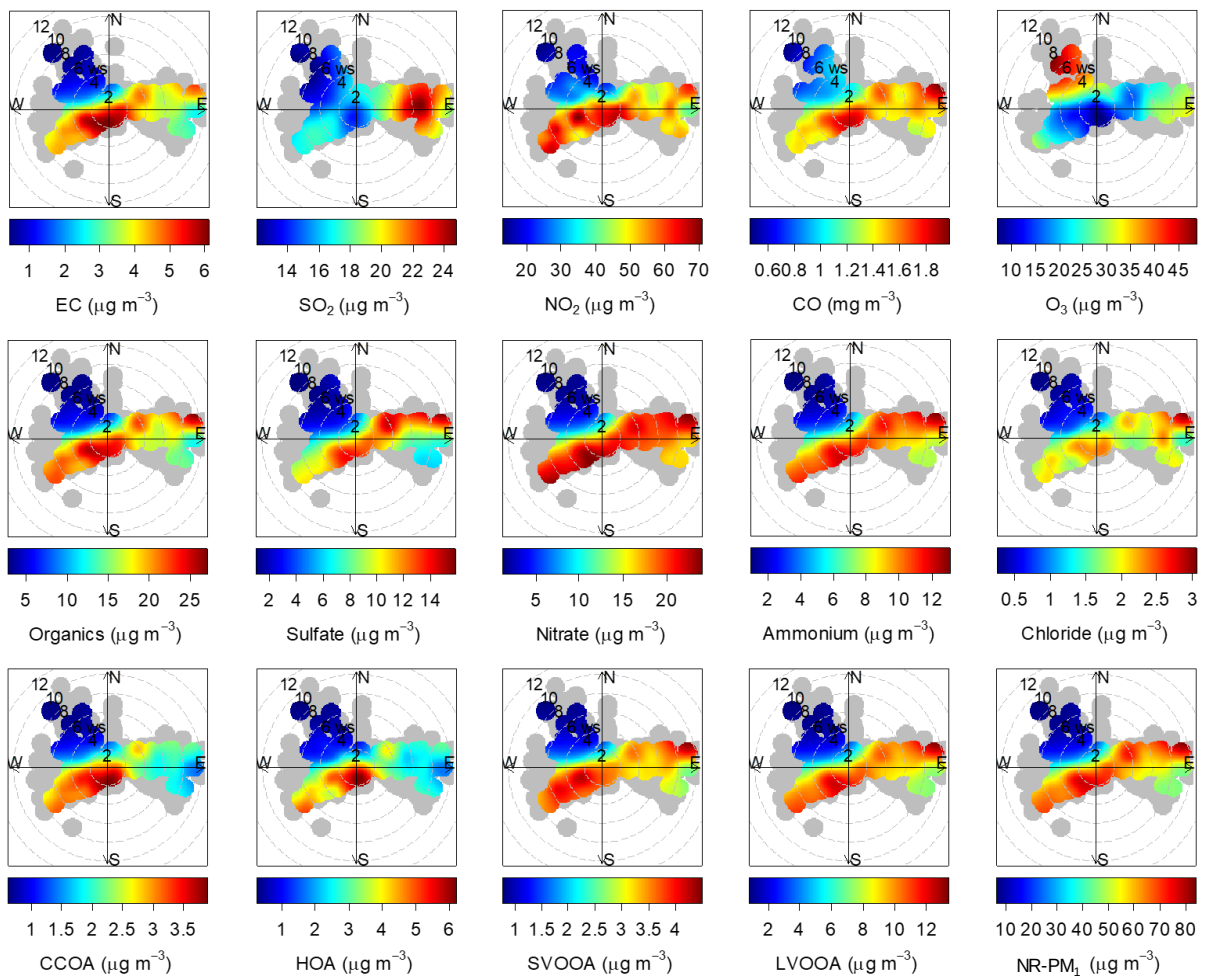
Downdraft in important for the increase in PM in cities located in the valley area.

△PM : the diurnal profiles of hourly change in PM.

The distribution of pollutants

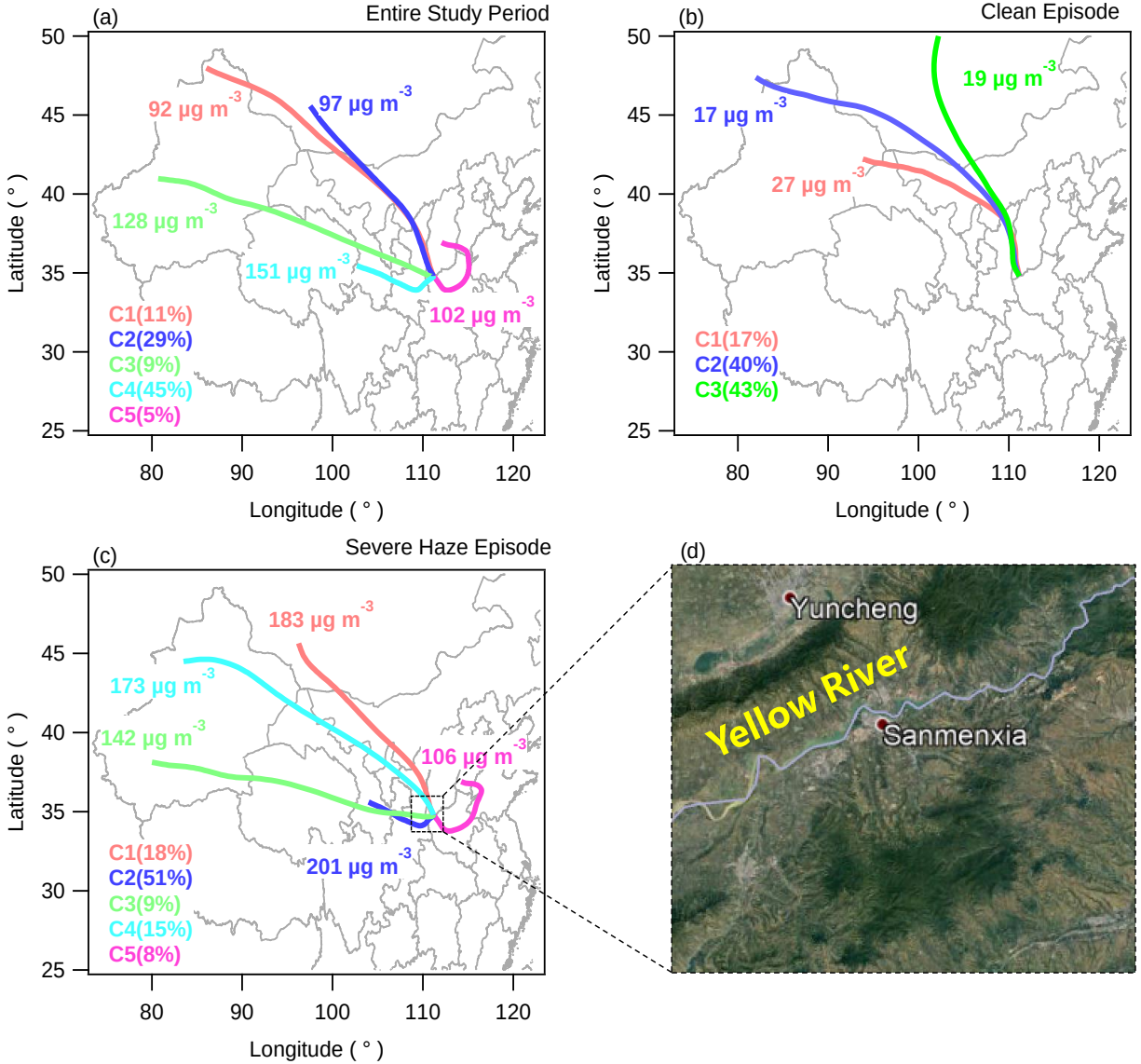


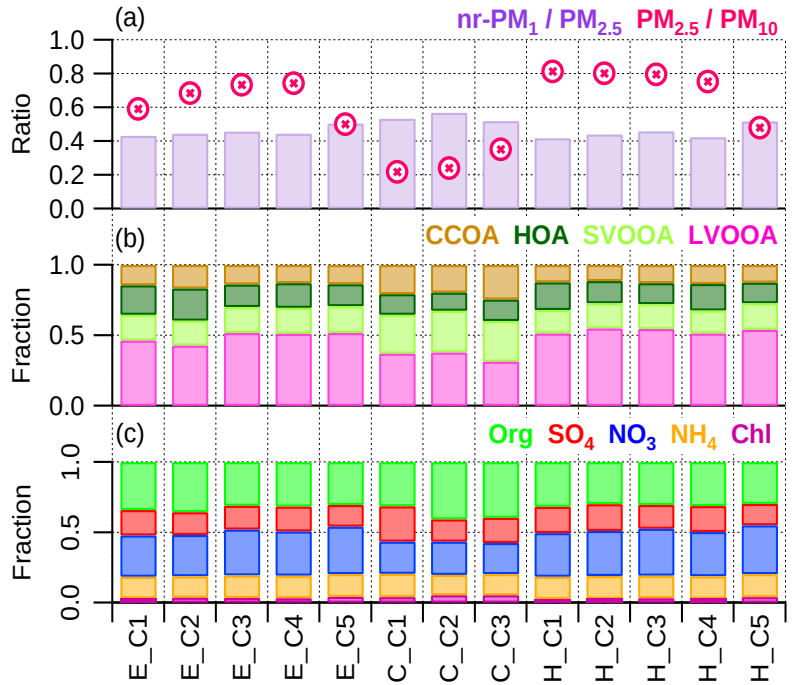
Local emission sources.



Sanmenxia is susceptible to pollutants from local and short-distance transport from the southwest.

Impact of large scale regional transport of pollutants on PM





Probably due to the canyon terrain, the impacts from remote surrounding provinces on pollution levels in Sanmenxia were insignificant, except for the strong northwesterly air masses that diluted pollutants and resulted in clean episodes.

Implications

- PM pollution continuously reduced from 2014 to 2019 in Sanmenxia in Central China, reflecting the implementation of cleaner production processes.
- However, PM is still at high level, e.g., in Jan. 2019, a severe haze event lasting for about 16 days with the average $PM_{2.5}$ was 181 μg m^{-3}.
- The significantly increased contributions of HOA, LVOOA, and NO_3^- during haze episode indicates that future air quality improvements in Sanmenxia will benefit substantially from a more efficient control of NO_x emissions from industry and vehicle emissions.
- Due to the canyon terrain, the evolution characteristics of pollution is interesting and different from that in cities in the plain area.

Acknowledgements
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Thanks for your attention!

Looking forward to your questions.
(wangqingqing@mail.iap.ac.cn)