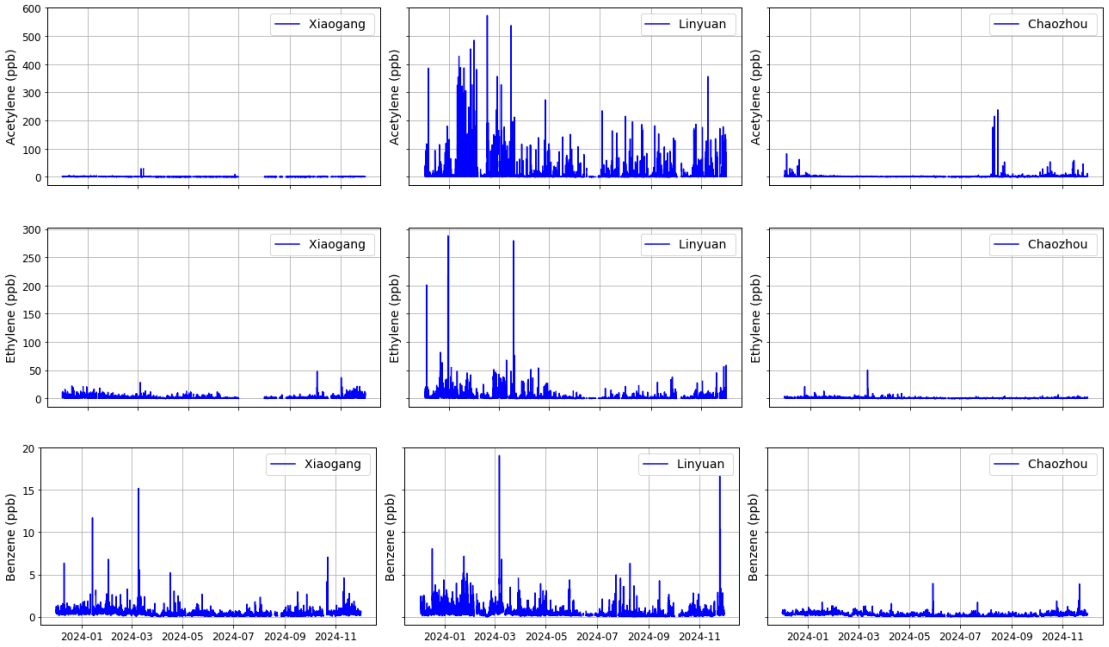
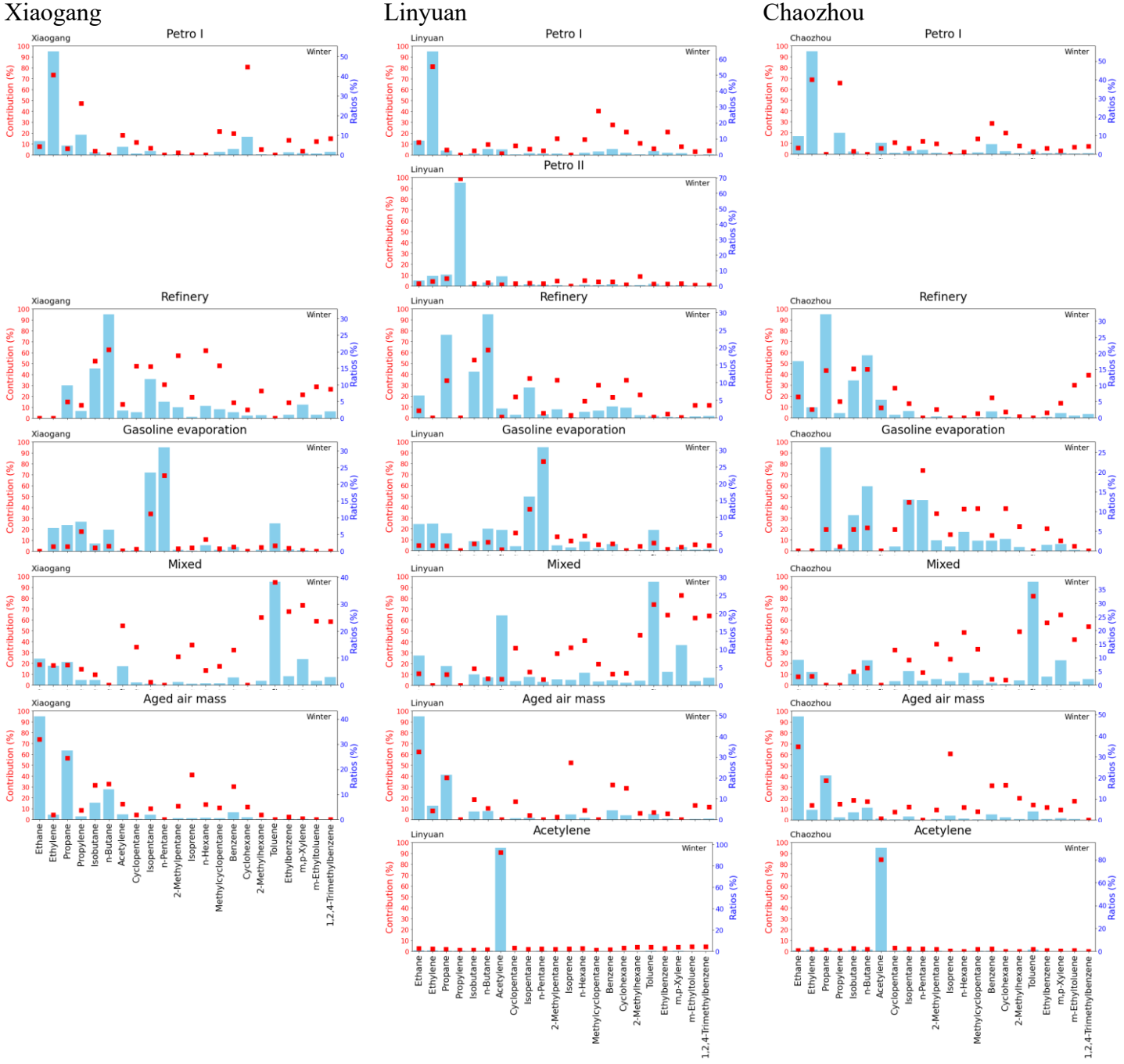
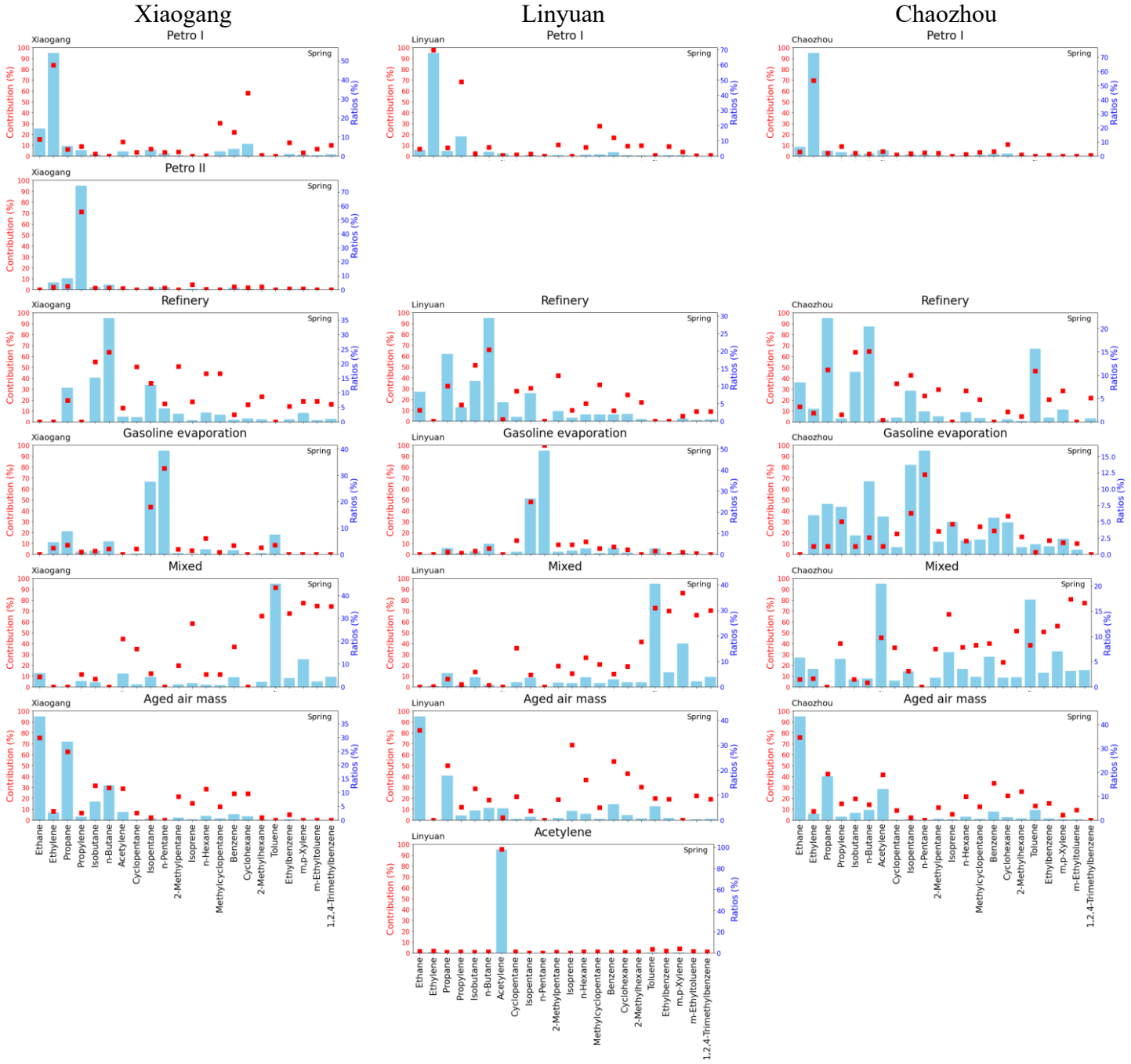


Fig. S1 High-temporal-resolution PAMS data (01/12/2023 – 30/112024). Examples of acetylene, ethylene, and benzene species

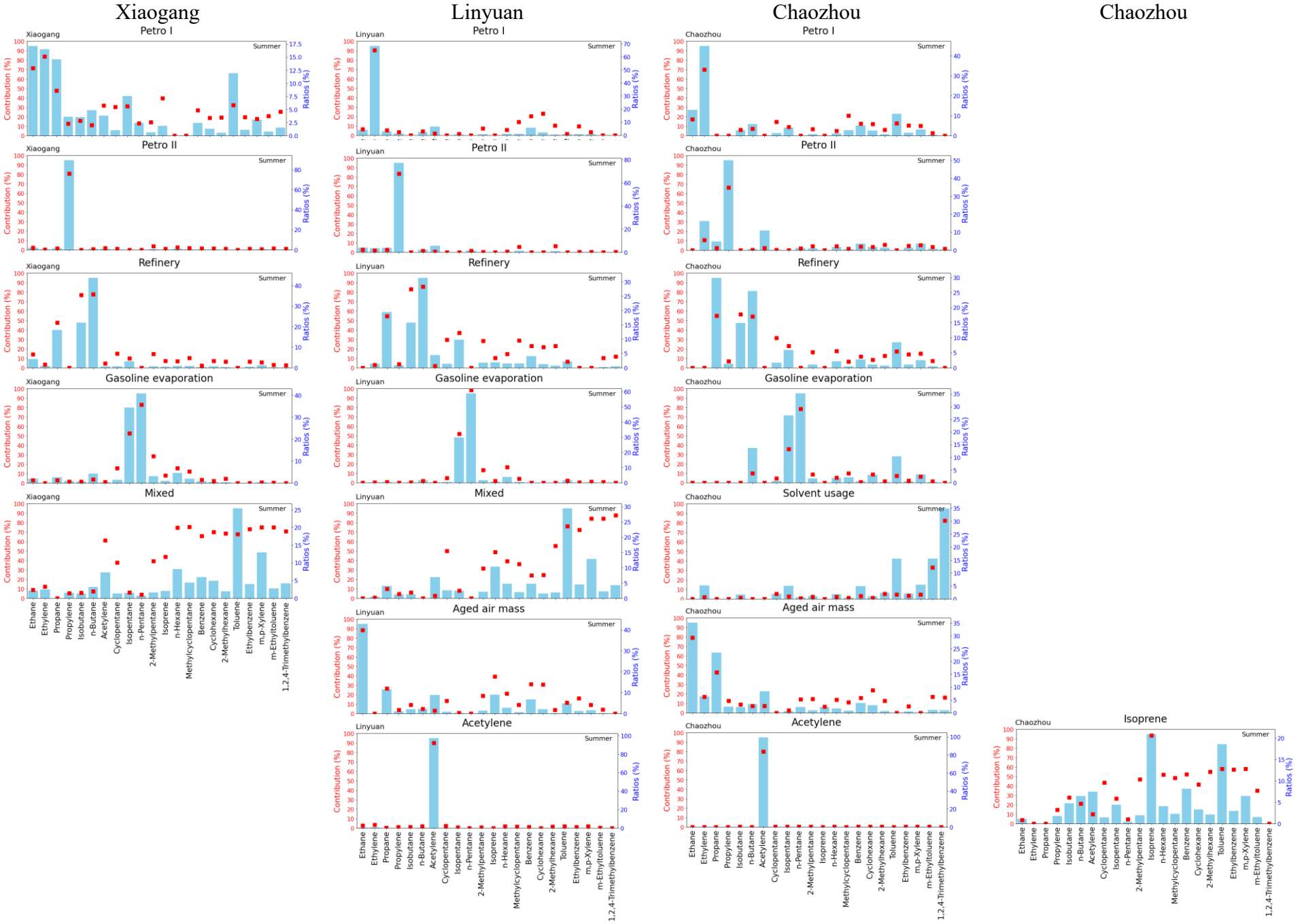
a) Winter


Xiaogang
Linyuan
Chaozhou
Petro I
Petro II
Refinery
Gasoline evaporation
Mixed
Aged air mass
Acetylene
Winter
Contribution (%)
Ratios (%)
Ethane
Ethylene
Propane
Propylene
Isobutane
n-Butane
Acetylene
Cyclopentane
Isopentane
n-Pentane
2-Methylpentane
Isoprene
n-Hexane
Methylcyclopentane
Benzene
Cyclohexane
2-Methylhexane
Toluene
Ethylbenzene
m,p-Xylene
m-Ethyltoluene
1,2,4-Trimethylbenzene

b) Spring


Xiaogang
Linyuan
Chaozhou
Petro I
Petro II
Refinery
Gasoline evaporation
Mixed
Aged air mass
Acetylene
Spring
Contribution (%)
Ratios (%)
Ethane
Ethylene
Propane
Propylene
Isobutane
n-Butane
Acetylene
Cyclopentane
Isopentane
n-Pentane
2-Methylpentane
Isoprene
n-Hexane
Methylcyclopentane
Benzene
Cyclohexane
2-Methylhexane
Toluene
Ethylbenzene
m,p-Xylene
m-Ethyltoluene
1,2,4-Trimethylbenzene

c) Summer


Xiaogang
Linyuan
Chaozhou
Chaozhou
Petro I
Petro II
Refinery
Gasoline evaporation
Mixed
Solvent usage
Aged air mass
Acetylene
Isoprene
Summer
Contribution (%)
Ratios (%)
Ethane
Ethylene
Propane
Propylene
Isobutane
n-Butane
Acetylene
Cyclopentane
Isopentane
n-Pentane
2-Methylpentane
Isoprene
n-Hexane
Methylcyclopentane
Benzene
Cyclohexane
2-Methylhexane
Toluene
Ethylbenzene
m,p-Xylene
m-Ethyltoluene
1,2,4-Trimethylbenzene

d) Fall

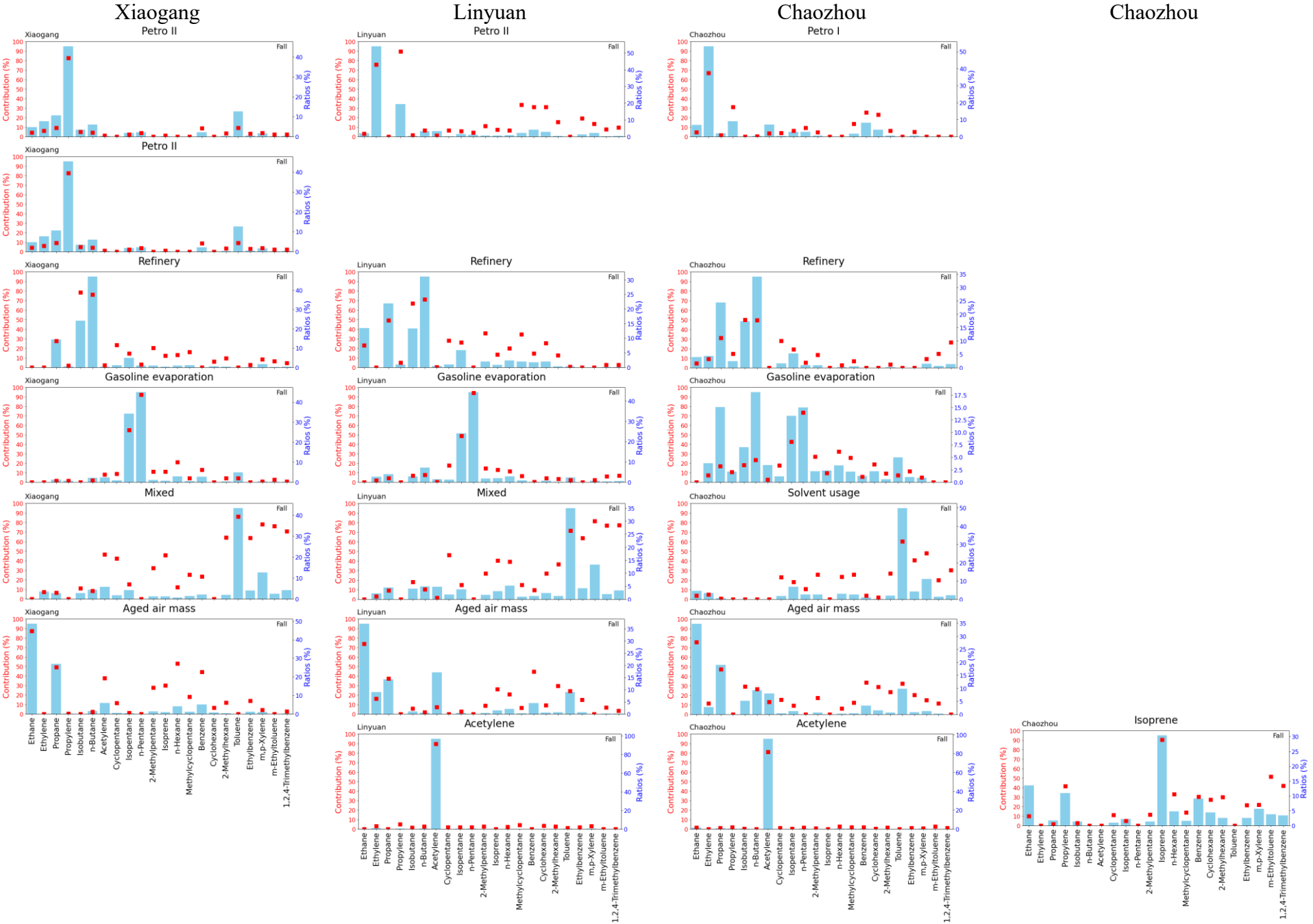


Fig. S2 Details of profile factors at study sites across the seasons: a) winter, b) spring, c) summer, d) fall

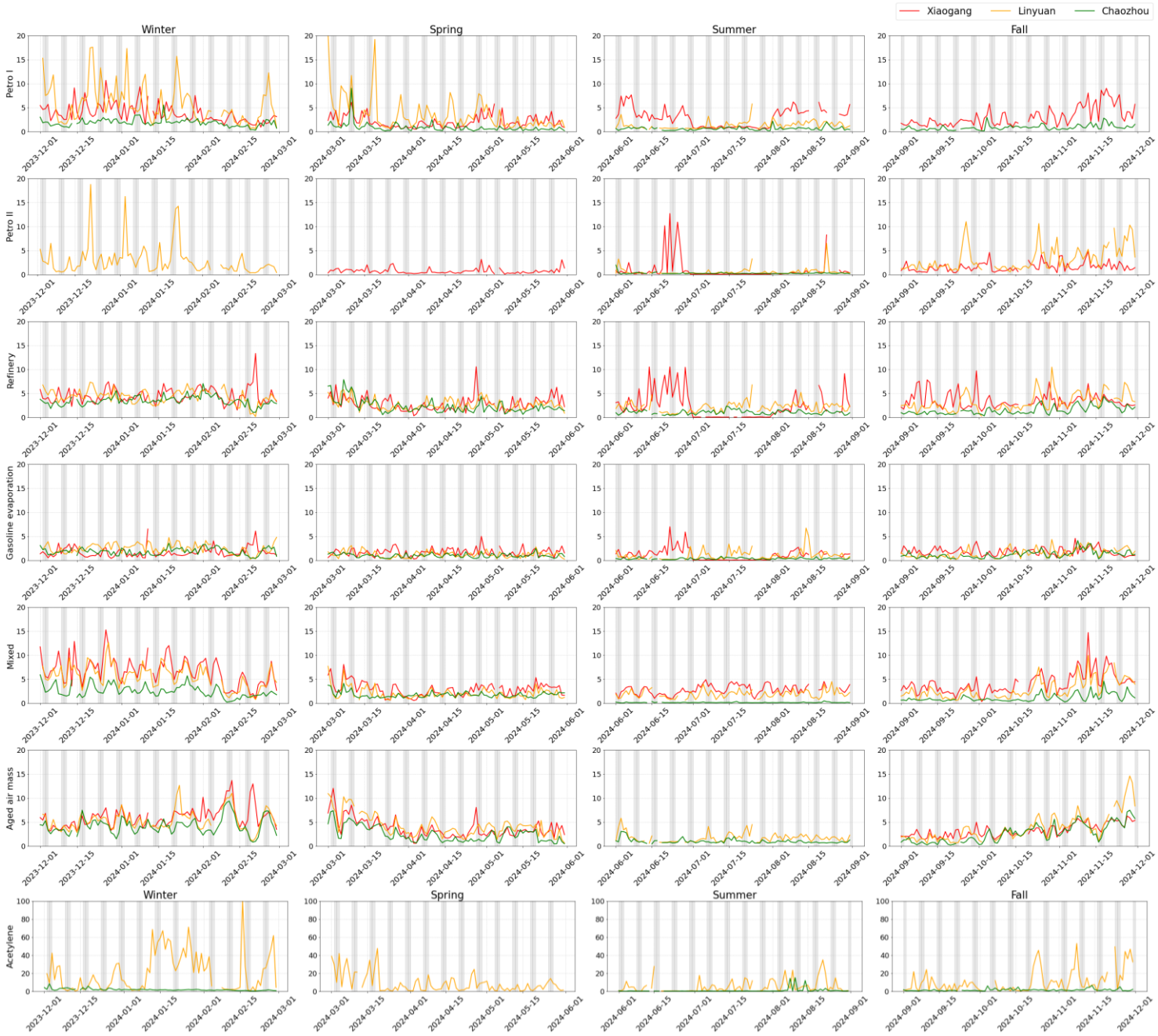


Fig. S3 Seasonal variation of daily mean contributions from PMF-resolved factors. Shaded columns represent weekends.

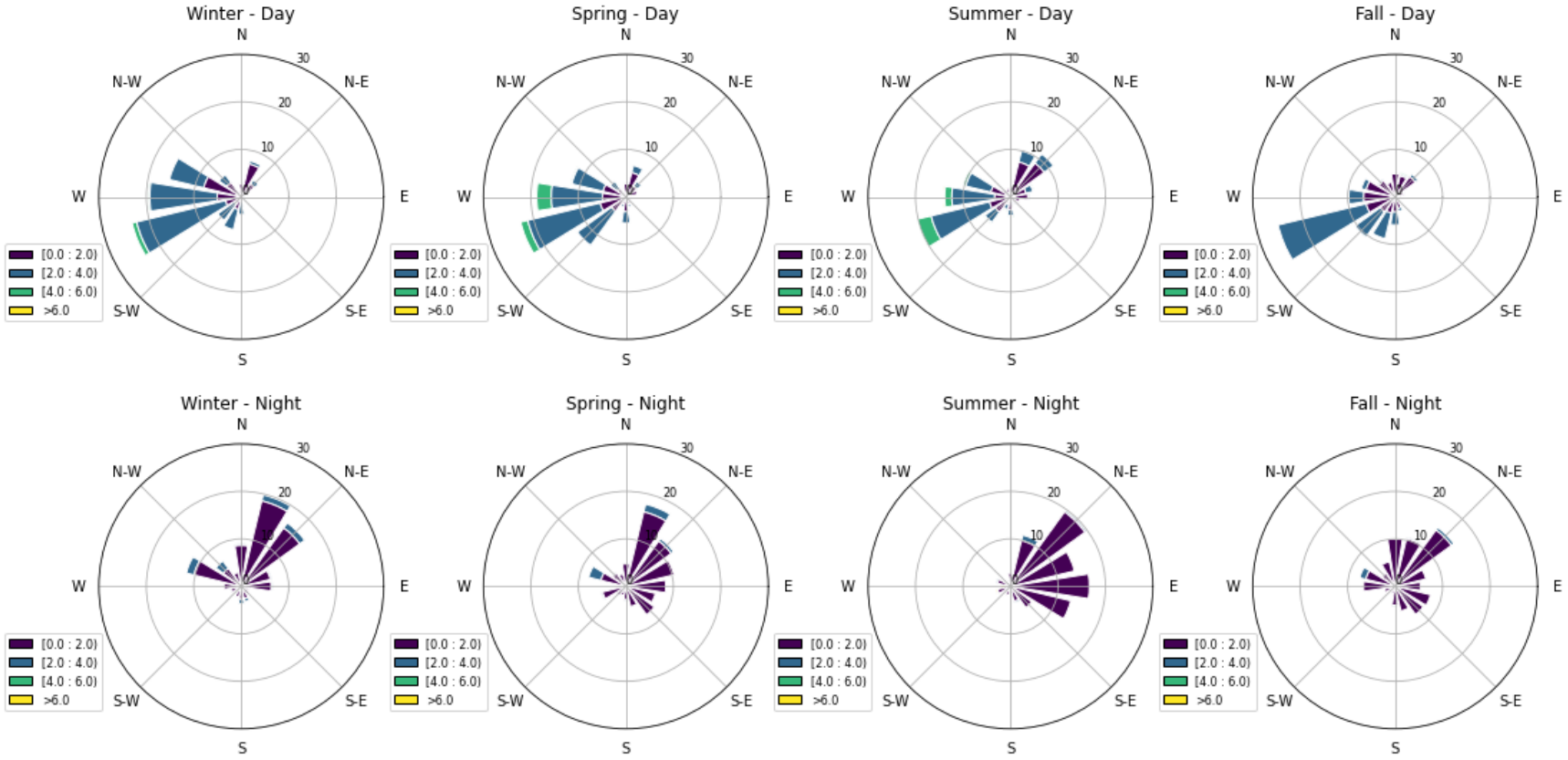


Fig. S4 Day-Night wind profile for aged air mass factor at Chaozhou over the seasons during top 30% high contribution

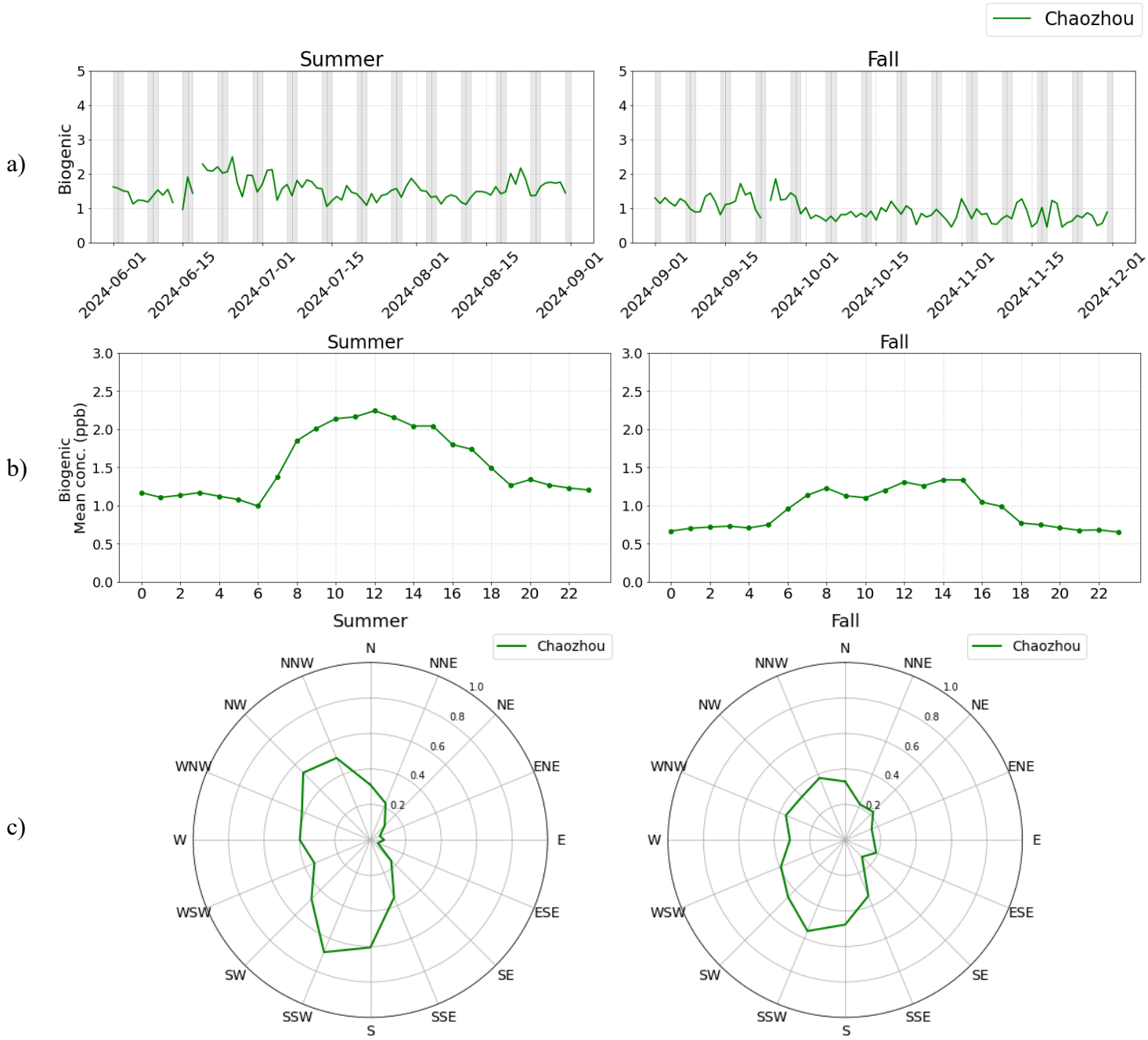


Figure S5: Temporal variation and CPF analysis for biogenic factors over the seasons, a) Timeseries of daily average factor contribution, b) Diurnal variation, and c) CPF analysis

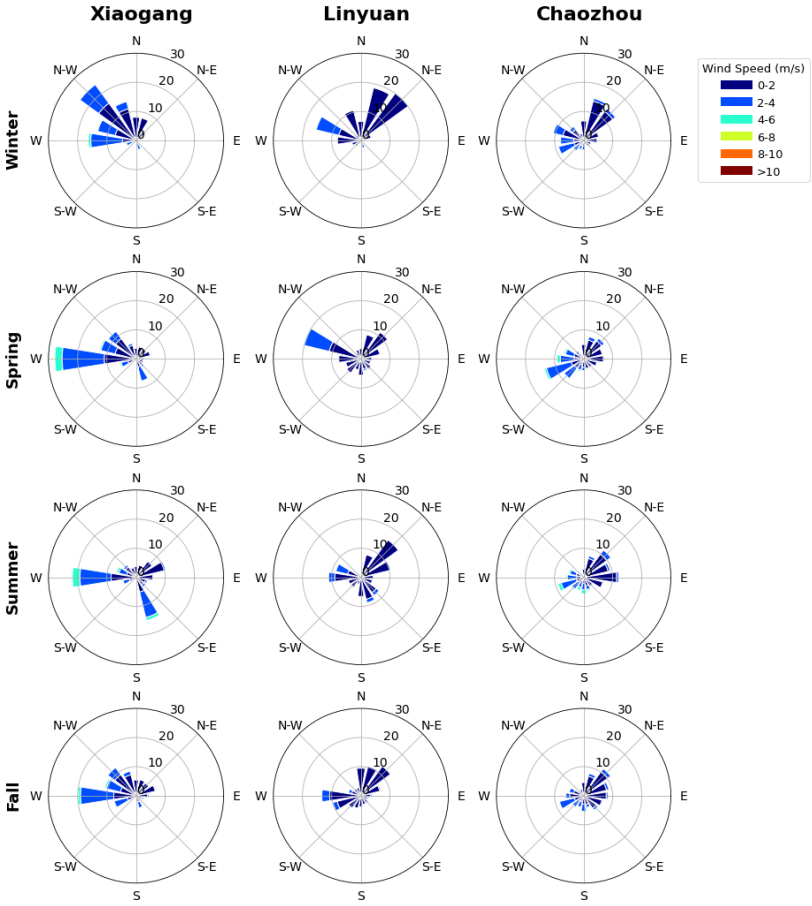


Figure S6: Seasonal wind profile at the three PAMS sites

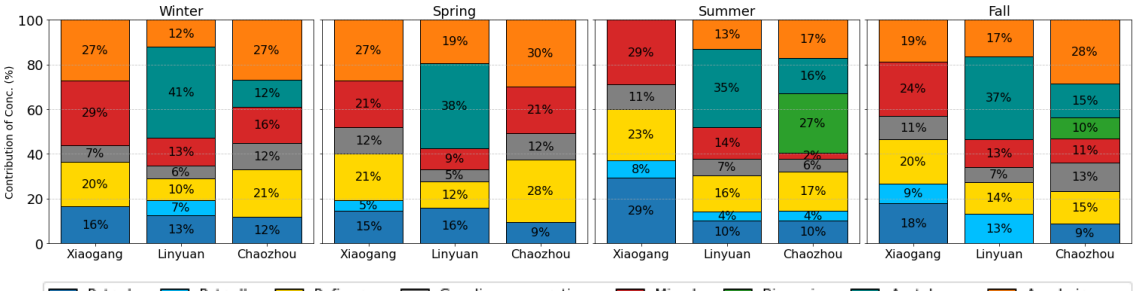


Figure S7: Contribution of concentration from eight resolved source factors. Xiaogang tends to have a relatively balanced influence among mixed, refinery, and aged air mass sources, suggesting complex source-receptor dynamics at this site. This reflects Xiaogang's transitional setting between industrial clusters and transportation hubs, where port activity, on-road emissions, and solvent-use industries intersect, producing overlapping chemical signals captured under the mixed factor.

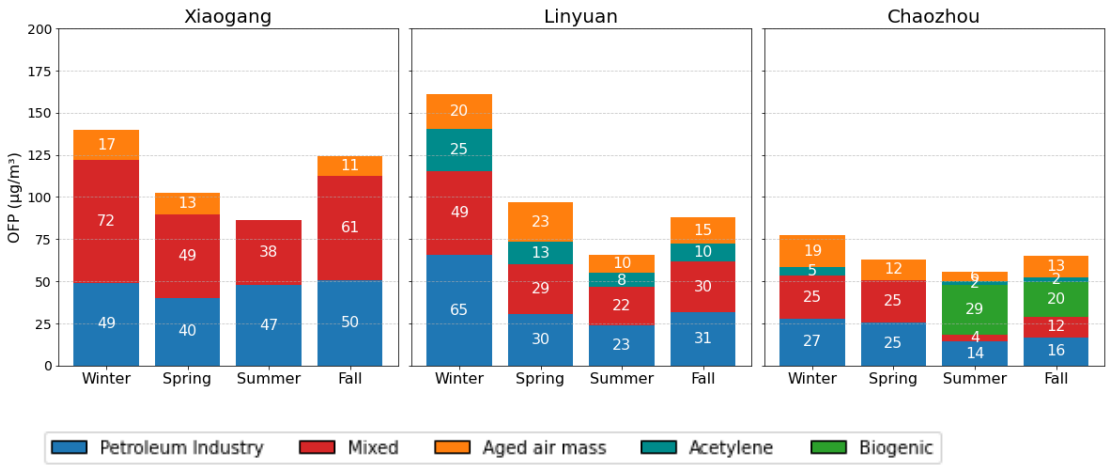


Figure S8: Ozone forming potential in perspective of seasonal variation

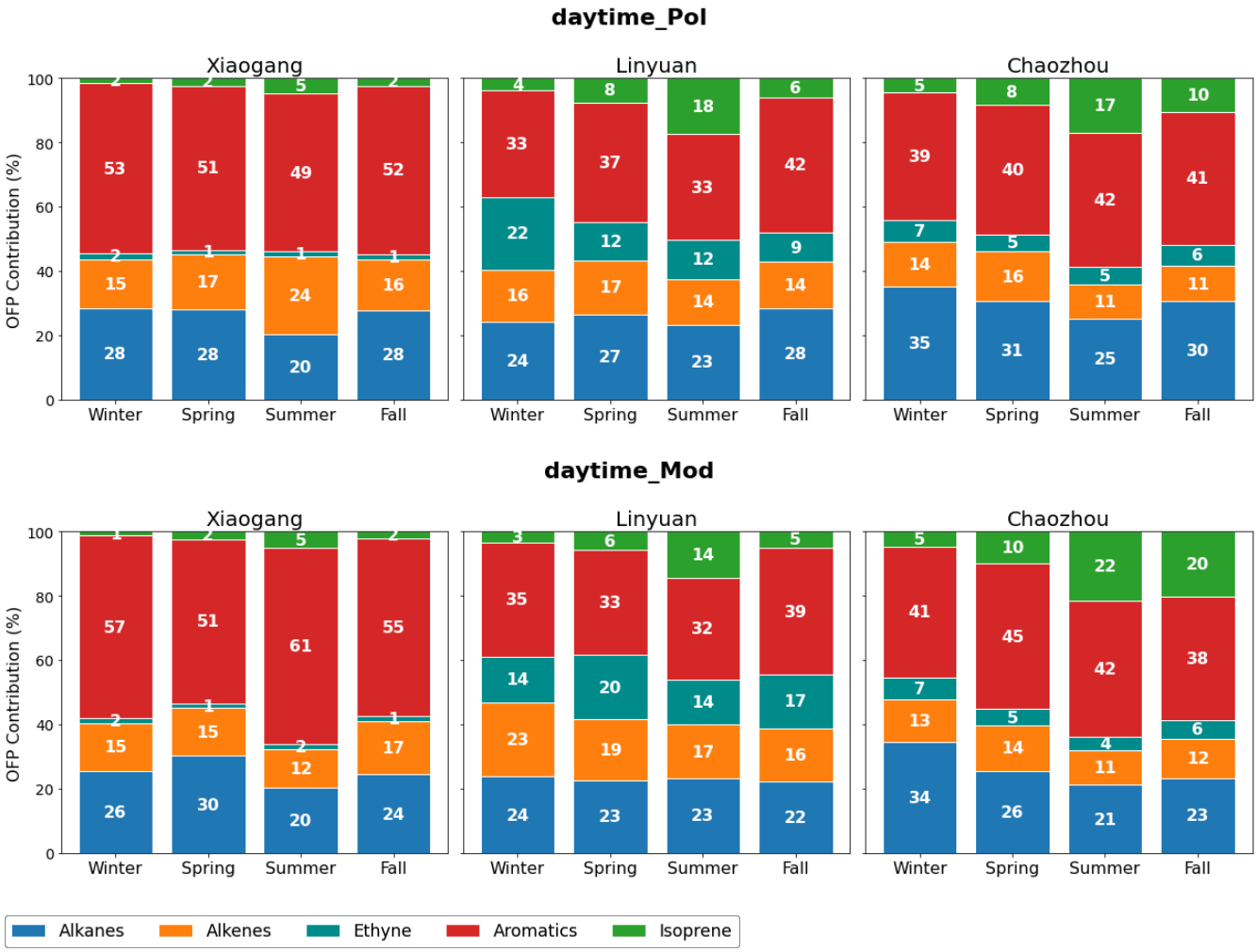


Figure S9: Ozone forming potential in perspective of species group variation during ozone pollution and moderate pollution days