

Chemical characterization and potential sources of submicron aerosol at a Mediterranean port city

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Motivation

- ❖ **Urban-Port Dynamics:** Urban coastal environments present a complex aerosol matrix where local traffic, domestic heating, and industrial emissions interact directly with intense maritime port activity.
- ❖ **High-Resolution Temporal Insights:** Continuous, year-long online monitoring (PM₁, trace elements, and trace gases) is critical to capturing transient emission plumes, seasonal variations, and diurnal dynamics at high temporal resolution.
- ❖ **Net4Cities** provides the observational framework needed to distinguish these contributions and evaluate their implications for urban air quality.



Methods



❖ **Location:** Limassol

❖ **Station:** CAO-LIM

❖ **Type:** coastal at port site

❖ **Period:** 2025–Present

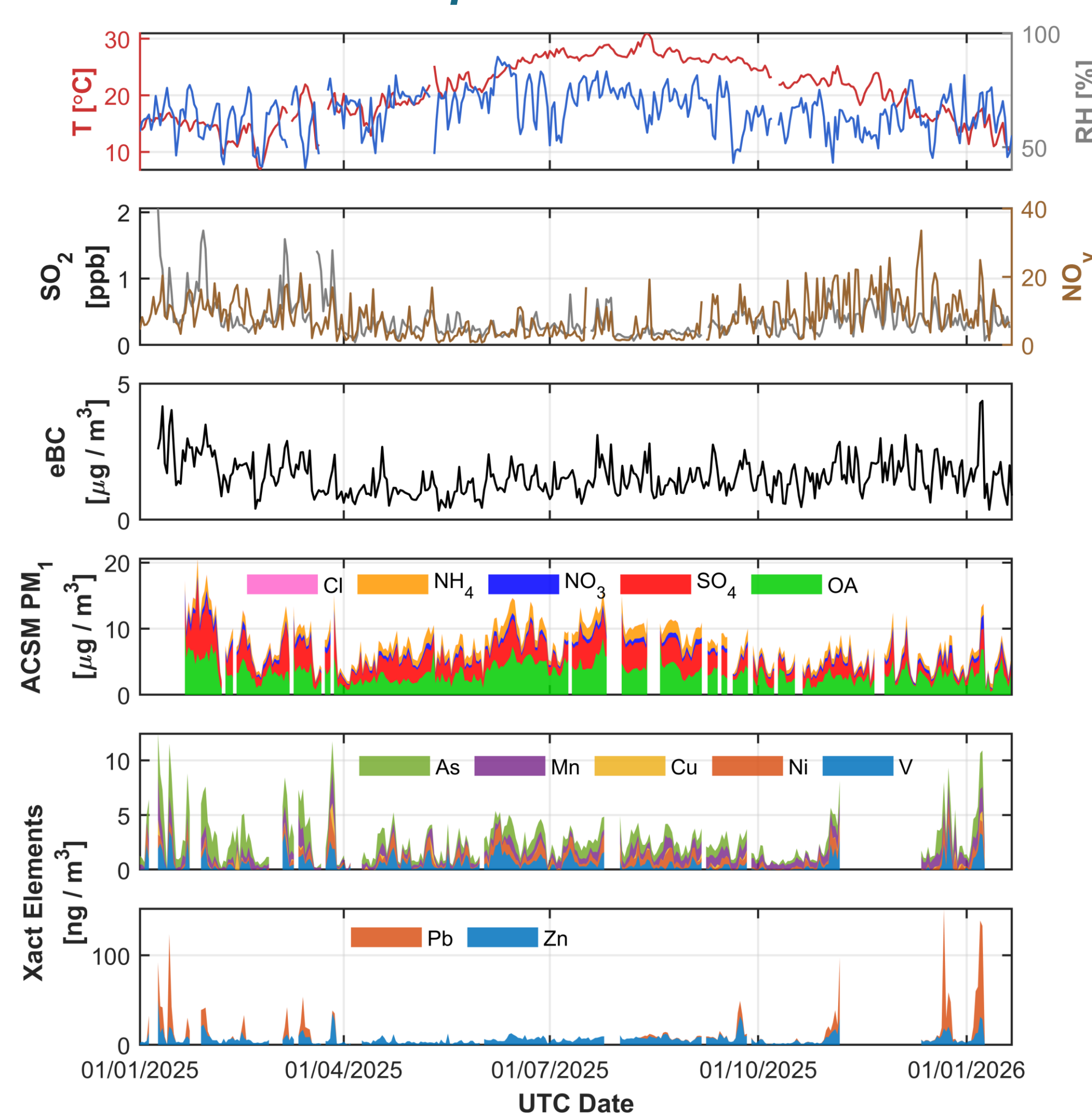
❖ **Showing:** Jan 2025–Jan 2026

❖ **Instruments:**

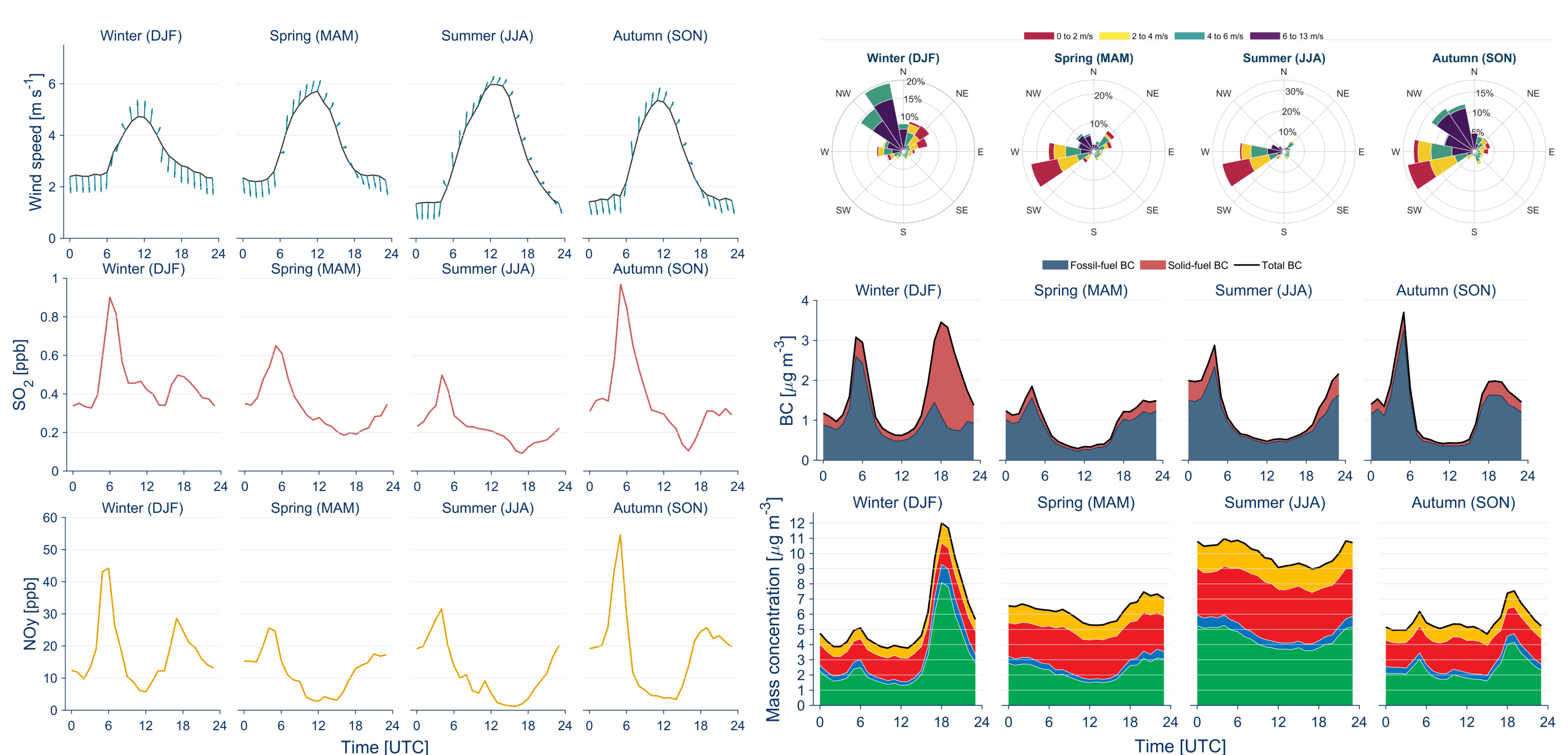
- Q-ACSM with PM₁ inlet
- Xact 625i with PM₁ inlet
- Aethalometer (AE33)
- Teledyne gas analyzers
- Fine dust monitor (Fidas 200)

Results

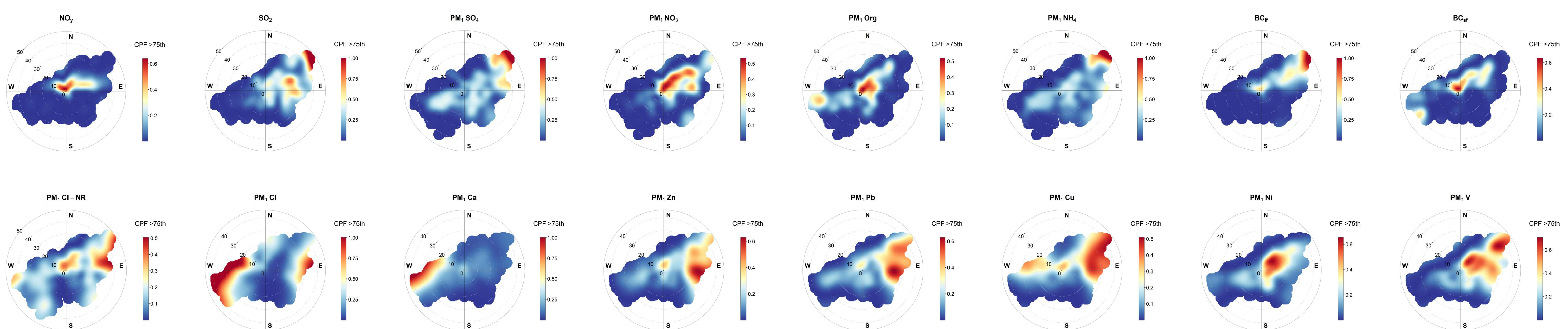
Overview of daily-averaged parameters



Diurnal variations of measured parameters averaged by season



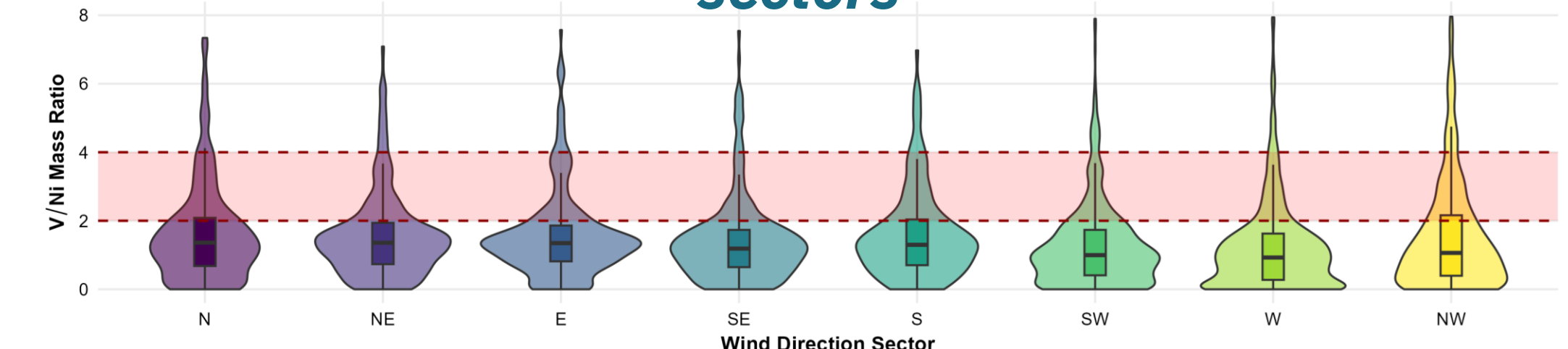
Conditional Bivariate Probability Function (CBPF) surface plots for trace gases and submicron aerosol species and trace elements.



Summary

- Submicron aerosol concentrations exhibit pronounced winter peaks for primary combustion species and summer increases in secondary sulfate.
- Black carbon source apportionment reveals strong morning and evening traffic peaks for fossil-fuel year-round, alongside clear winter evening spikes in solid-fuel driven by residential heating.
- High-concentration events of industrial tracers (V, Ni, Pb, SO₂) show a dominant east-northeastern spatial footprint, outranking the local harbor sector.
- V/Ni between 0.5–2 confirm mixed shipping & industrial impacts, reflecting lower ratios typical of modern low-sulfur fuels compared to traditional HFO thresholds (2–4).

V to Ni ratio from different wind sectors



- Implement comprehensive QA/QC validation across all high-resolution time series.
- Execute ACSM–Xact–AE33 PMF receptor modeling to apportion specific source sectors.
- Conduct comparative source allocation analyses with Net4Cities partner sites