Seasonal and fractional variability of particle-bound PAHs in an urban environment

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Overview

- Background
- Purpose
- Methods
- Results
- Summary
- Q&A

Background

- Particle-bound toxic compounds are essential for the assessment of human health because the deposition behavior of inhaled PM in the human respiratory tract depends strongly on particle size
- Toxic activities per unit mass of ultrafine particles (UFPs) are significantly higher than those of accumulation mode and coarse particles
- The contribution rate of UFPs to PAH deposition is less known in the respiratory tract

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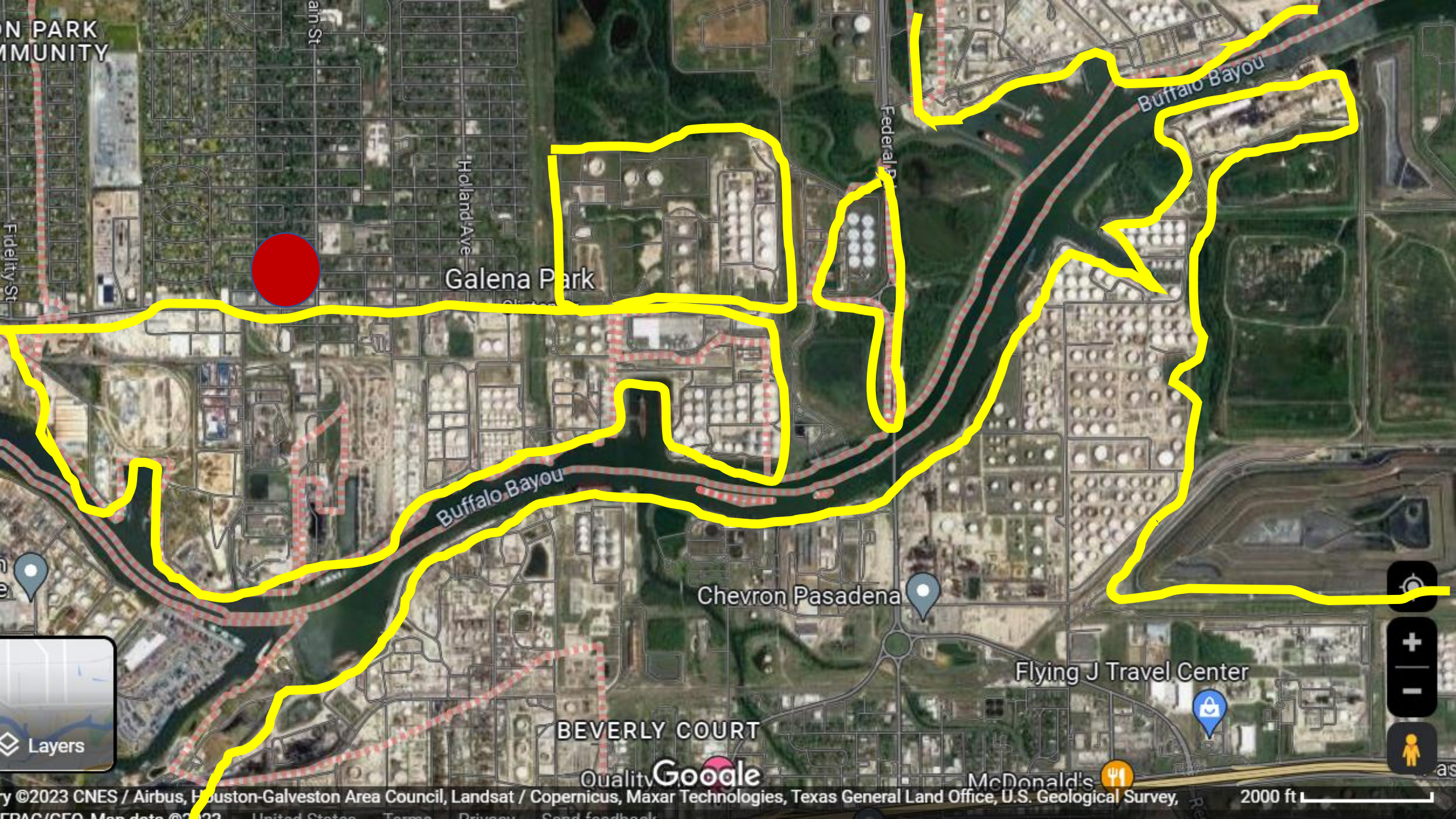
Purpose

- Characterize seasonal and fractional variability of particle-bound PAHs in an urban area with industrial facilities and heavily trafficked roadways.
- To provide size-resolved compositional data for further health studies.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Buffalo Bayou
Chevron Pasadena
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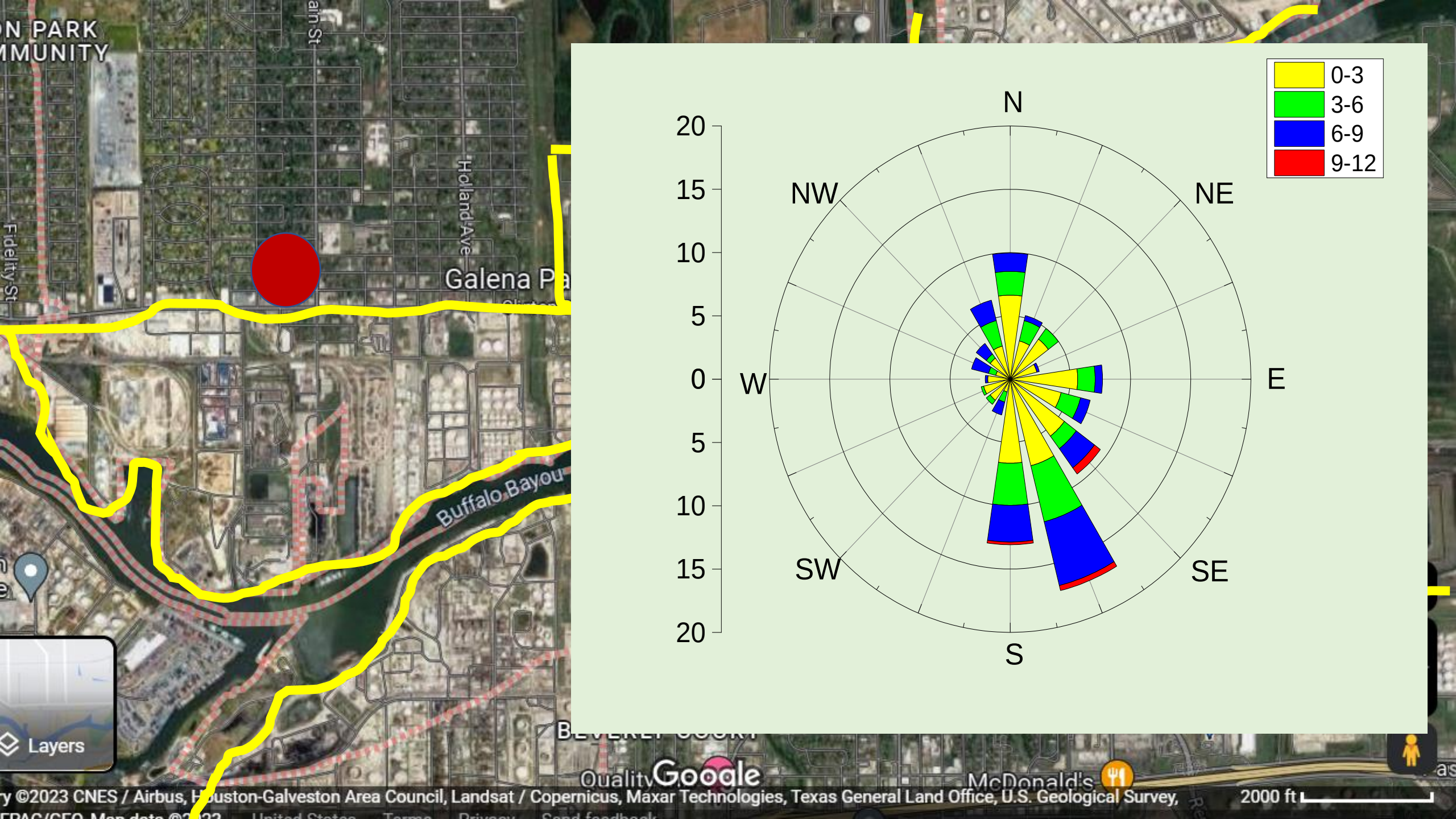
2000 ft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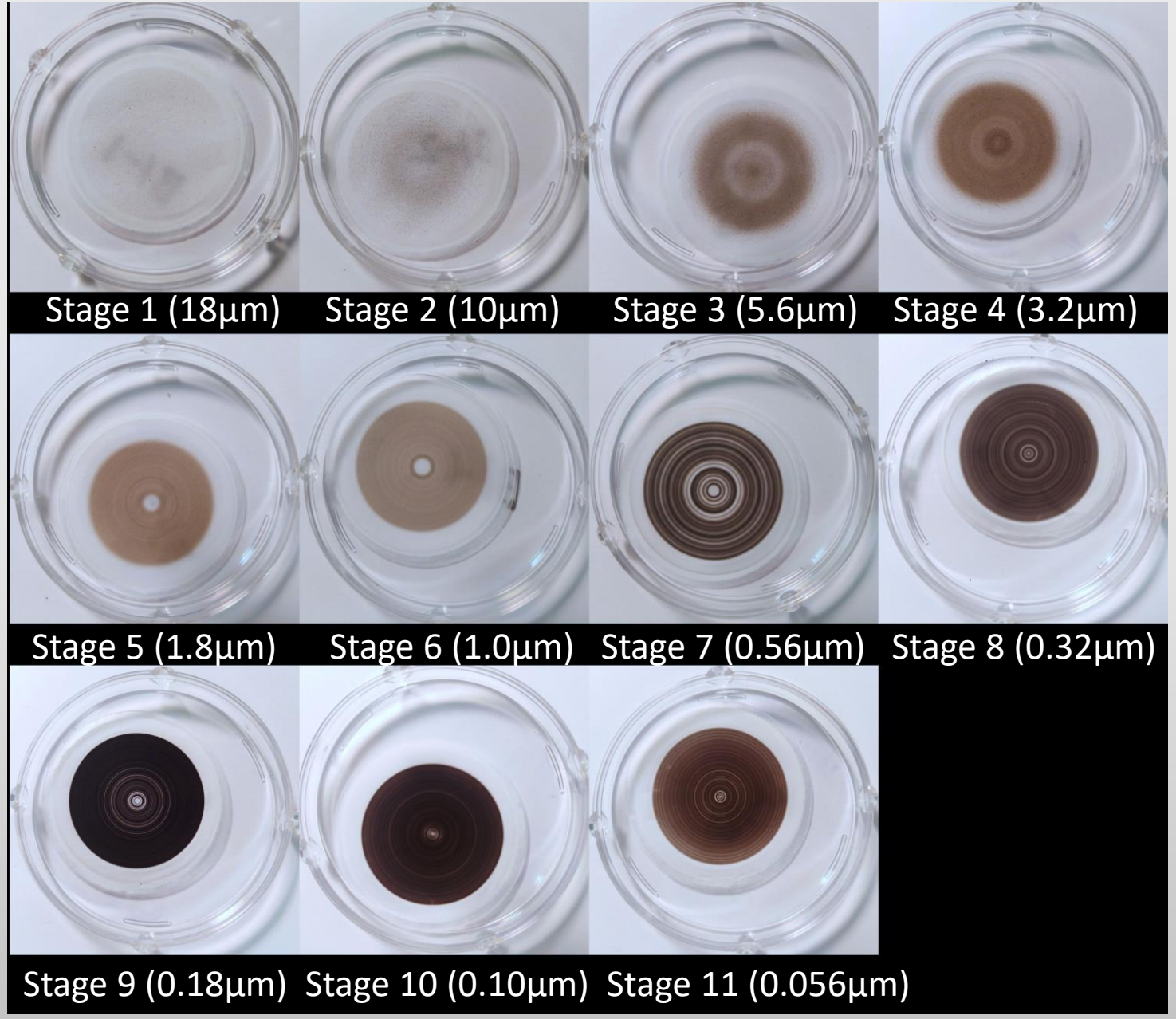
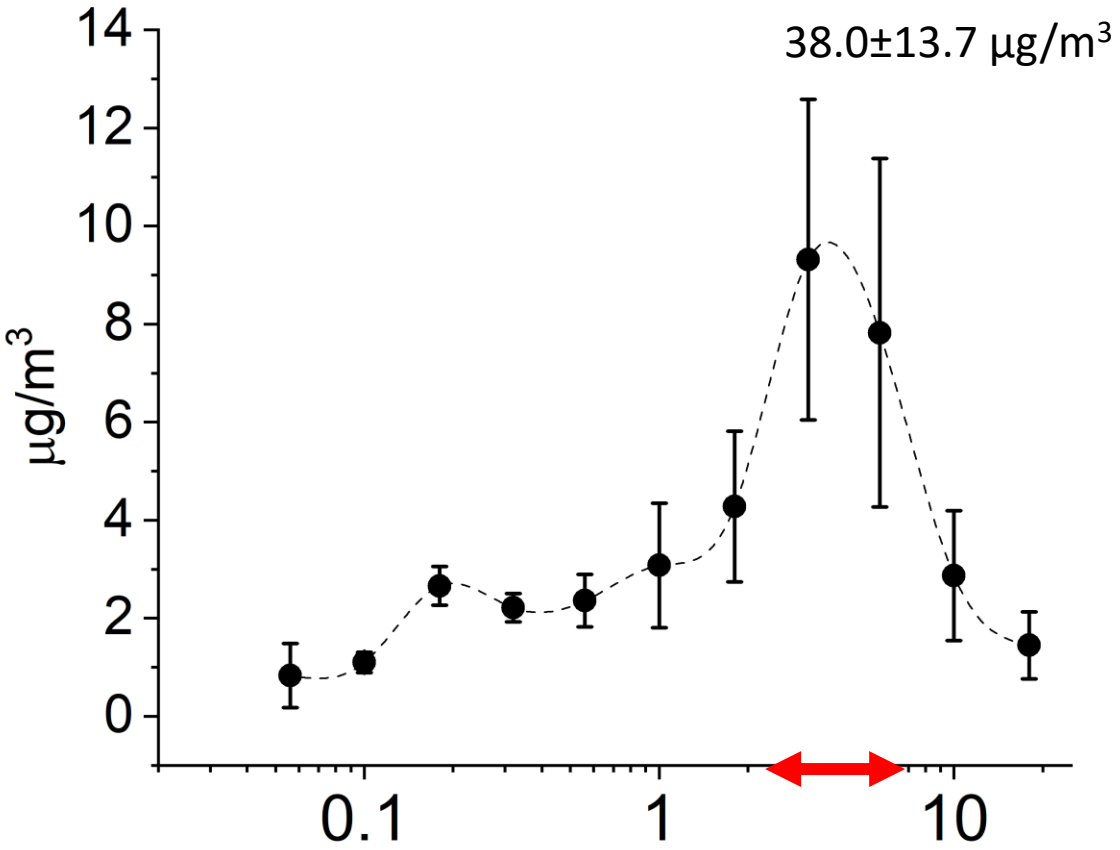
Methods

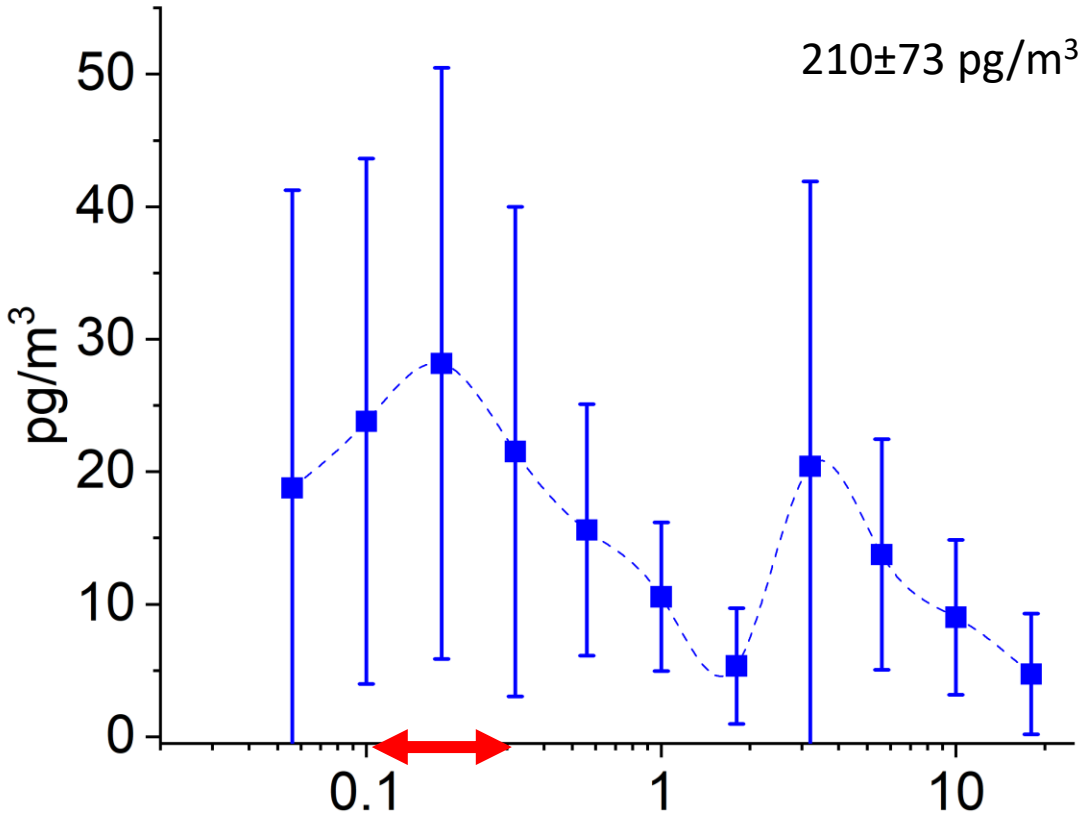
- 11-stage cascade impactor
  - 0.056 – 18 µm
- Sampling campaign duration
  - June 2021 – May 2022
- Size resolved particle mass
- Particle bound PAHs analyzed (NIOSH 5515)


Stage 1 (18µm)
Stage 2 (10µm)
Stage 3 (5.6µm)
Stage 4 (3.2µm)
Stage 5 (1.8µm)
Stage 6 (1.0µm)
Stage 7 (0.56µm)
Stage 8 (0.32µm)
Stage 9 (0.18µm)
Stage 10 (0.10µm)
Stage 11 (0.056µm)

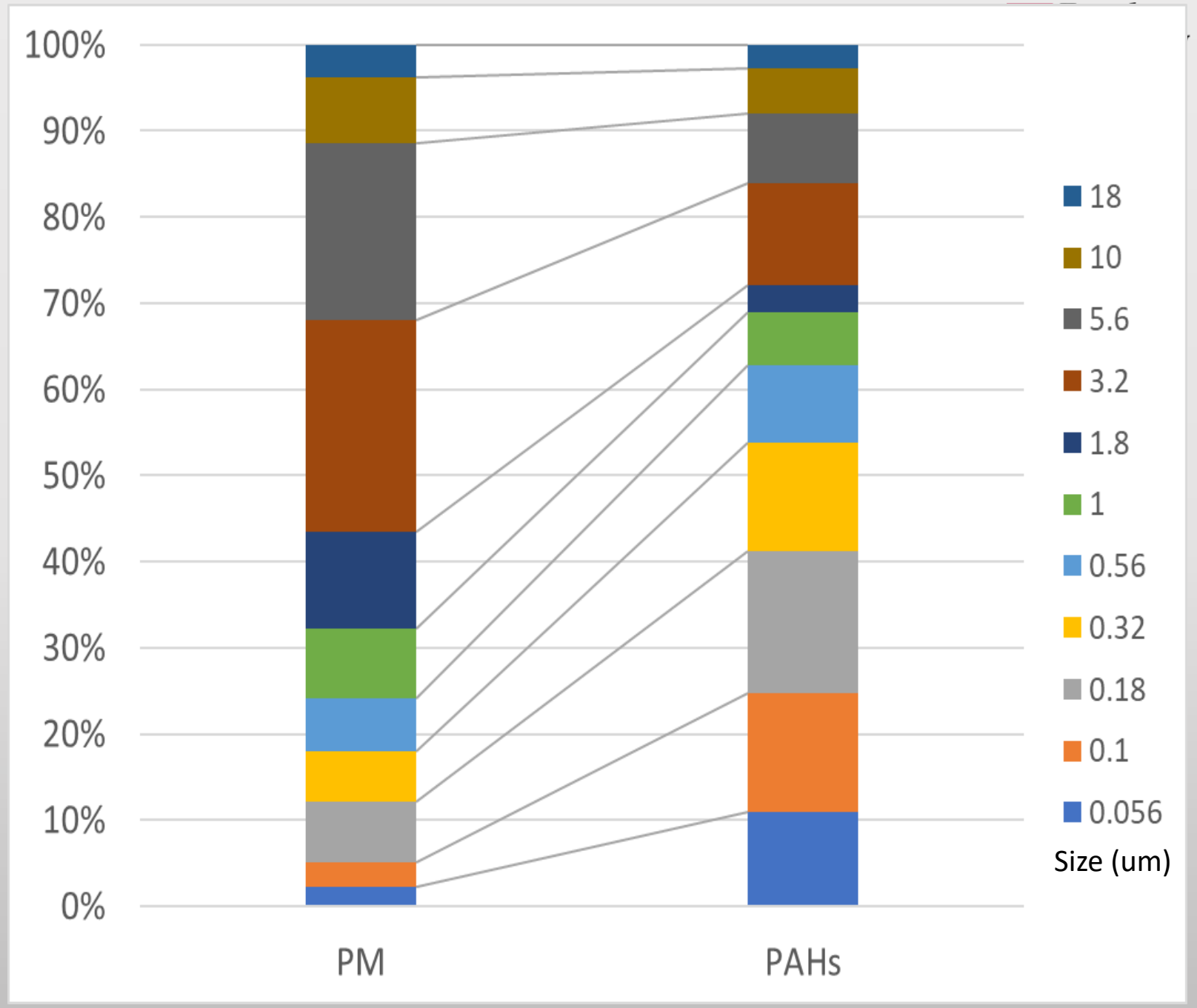
PM Size Distribution



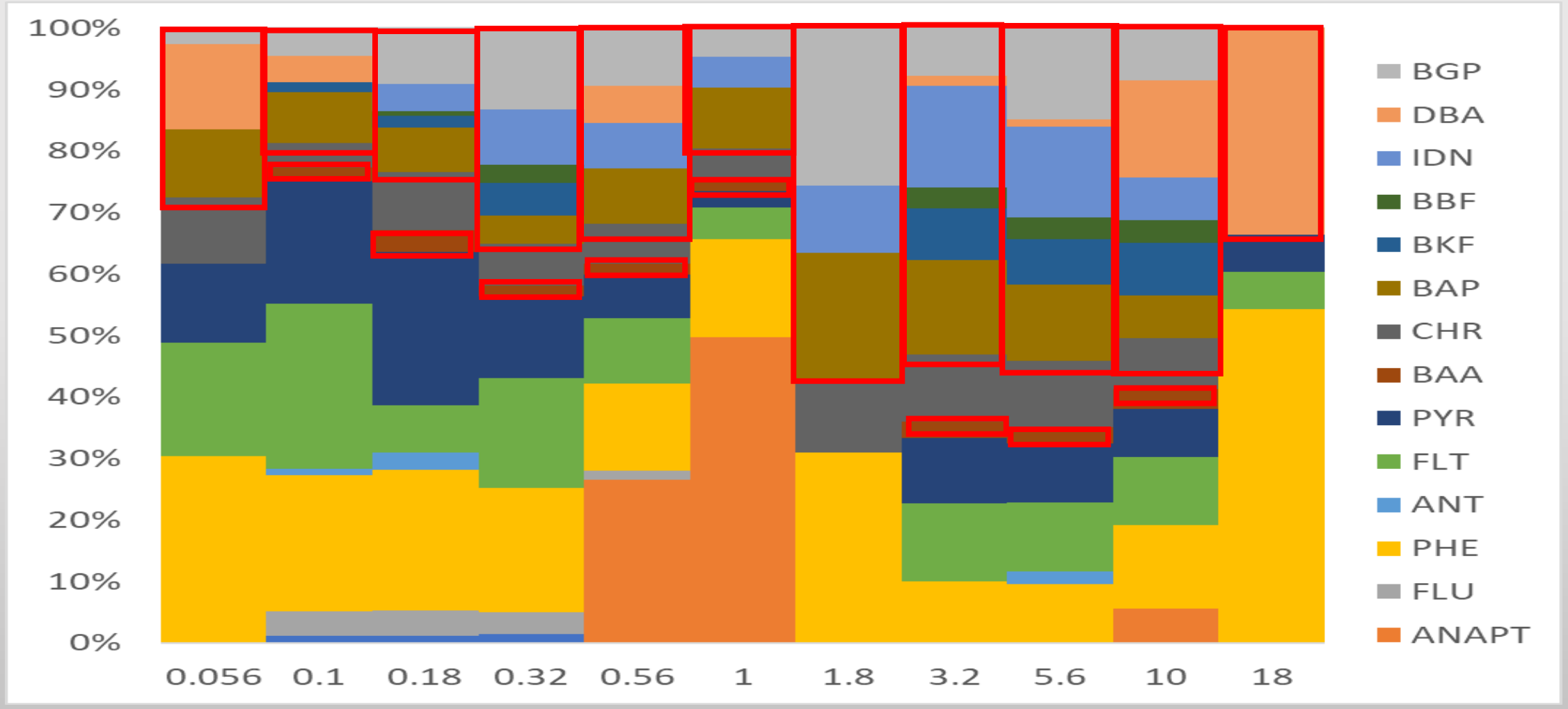
TPAH Size Distribution



Proportion of concentrations by size fractions between PM and TPAHs



Proportion of individual PAHs by size fraction



Seasonal variability (PM)

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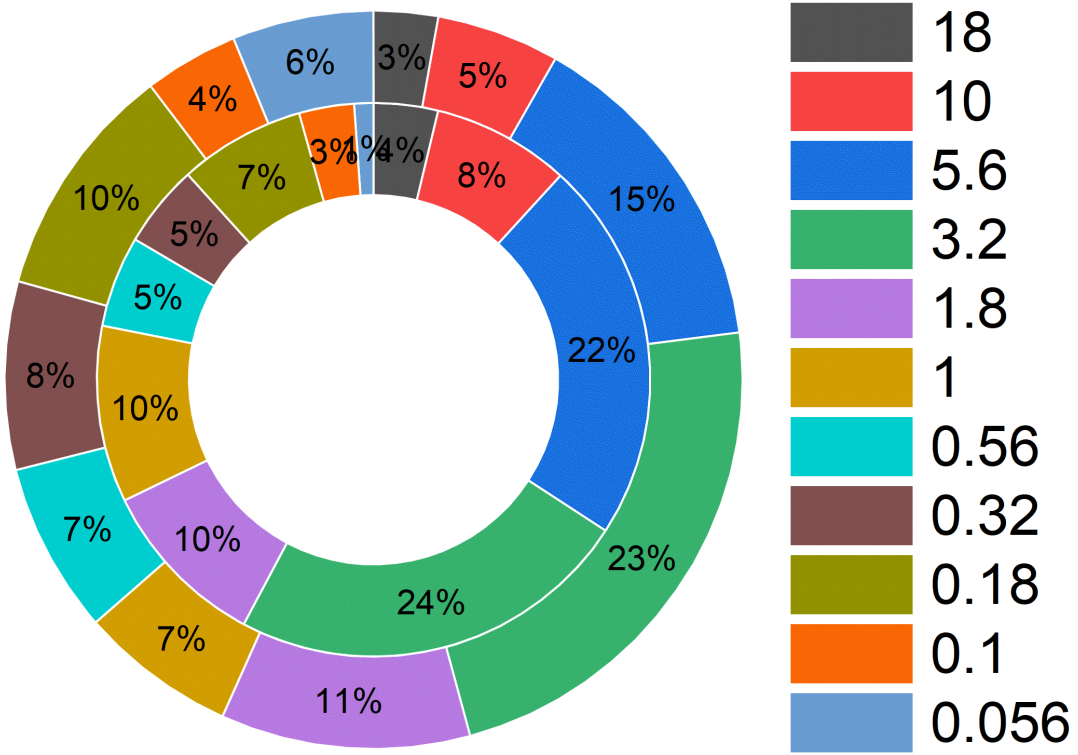
Cool season (outside ring)
Warm season (inside ring)



Season variability (TPAHs)

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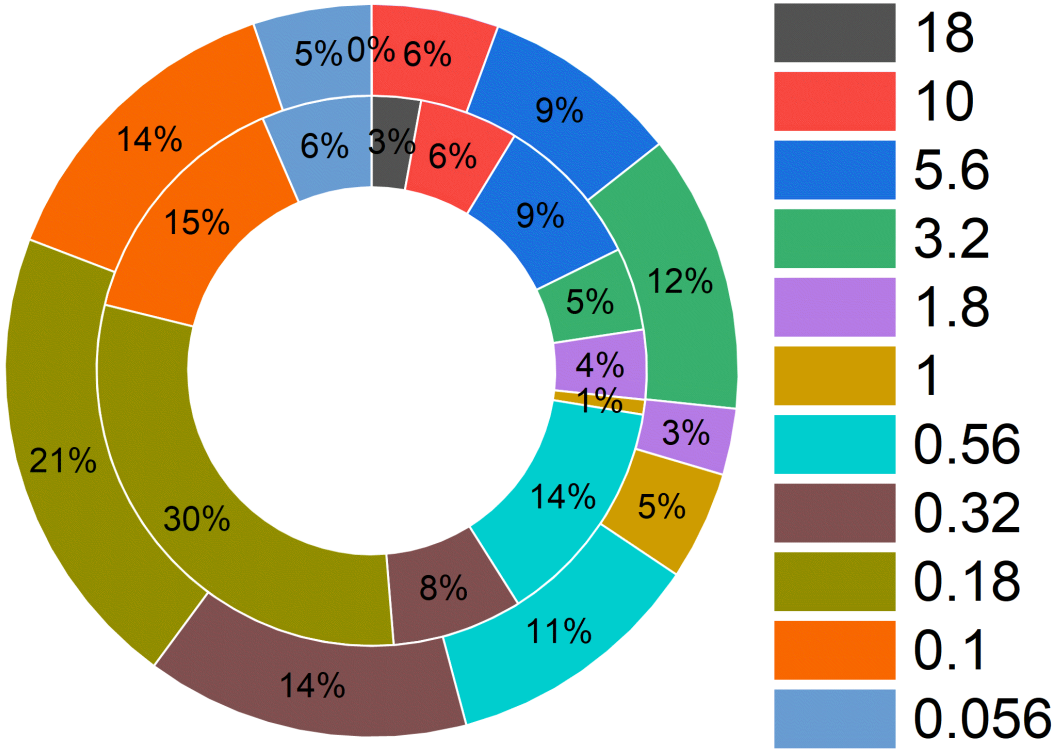
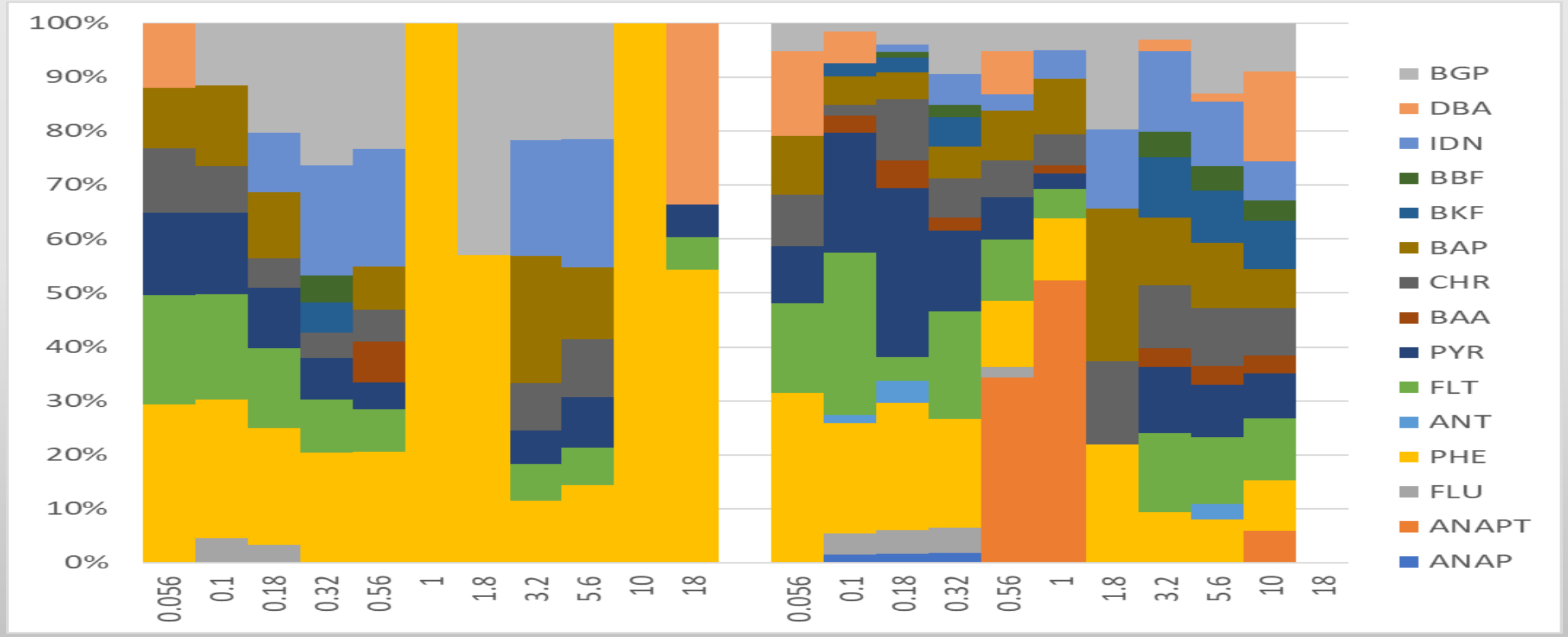
Cool season (outside ring)
Warm season (inside ring)



Seasonal variability (Individual PAHs)

Warm Season

Cool Season



Summary

- The sum of TPAHs were 210±73 pg/m^3
  - Three-ring PAHs accounted for 56% of the total PAHs, followed by five-ring PAHs (23%), six-ring PAHs (10%), and four-ring PAHs (9%)
  - During the cool season (November to April), the cumulative sum of 18 PAHs was 22% higher compared to the warm season (May to October)
  - PAHs emitted during the cool season originated from various combustion sources, differentiating them from those observed during the warm season
  - Size-fractionated PAHs were distributed as follows: 61% in fine-size bins, 25% in ultrafine size bins, and 14% in coarse-size bins, contributing to the total PAH levels

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Next Step

- Estimating the deposition of individual PAHs in different size fractions within the respiratory system
- Calculating the inhalation dosimetry of PAH
- Assessing the health risks associated with the inhalation of PAHs in various size modes (e.g., ultrafine, fine, and coarse particles)

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Q&A

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