Ultrafine Particles –
Air Quality and Climate
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Carcinogenic organic compounds in PM_1 particle fraction at an urban location with "canyon" effect

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Introduction

PM is considered as one of the major pollutants that may cause adverse effects on human health

PM_1 particles - aerodynamic diameter smaller than 1 µm

The mass concentration of particulate matter is not the only important parameter for the health risks assessment of atmospheric pollution

Toxic compounds can be adsorbed on fine and ultrafine fraction

Many compounds bound to particulate matter, such as polycyclic aromatic hydrocarbons (PAH), are suspected to be genotoxic, mutagenic and carcinogenic

More than 500 PAHs have been identified in the air

PAH - products of the incomplete combustion of fossil fuels and other organic materials and originate from a different types of natural and industrial processes

- were among the first pollutants recognized as potential carcinogens

Materials and methods

Sampling of atmospheric particulate matter

Samples were collected during 1 year, continuously from January to December 2019, 24 h a day

The PM_1 fractions were collected on quartz filters with a low volume Sven Leckel sampler from about 55 m^3 of air

City street location surrounded by tall buildings.

„Canyon" effect - pollutants strongly accumulate in a small area due to weak ventilation

Sample preparation and analysis

Ultrasonic
extraction
1 hour

Cyclohexane: toluene 3:7

Centrifugation
10 min; 3000 rpm

Evaporation

re-dissolved
in acetonitrile

mobile phase
acetonitrile : water
60:40

11 PAHs were determined:

- Fluoranthene (Flu)
- Pyrene (Pyr)
- Benzo(a)anthracene (BaA)
- Chrysene (Chry)
- Benzo(j)fluoranthene (BjF)
- Benzo(b)fluoranthene (BbF)
- Benzo(k)fluoranthene (BkF)
- Benzo(a)pyrene (BaP)
- Dibenzo(ah)anthracene (DahA)
- Benzo(ghi)perylene (BghiP)
- Indeno(1,2,3-cd)pyrene (IP)

Results

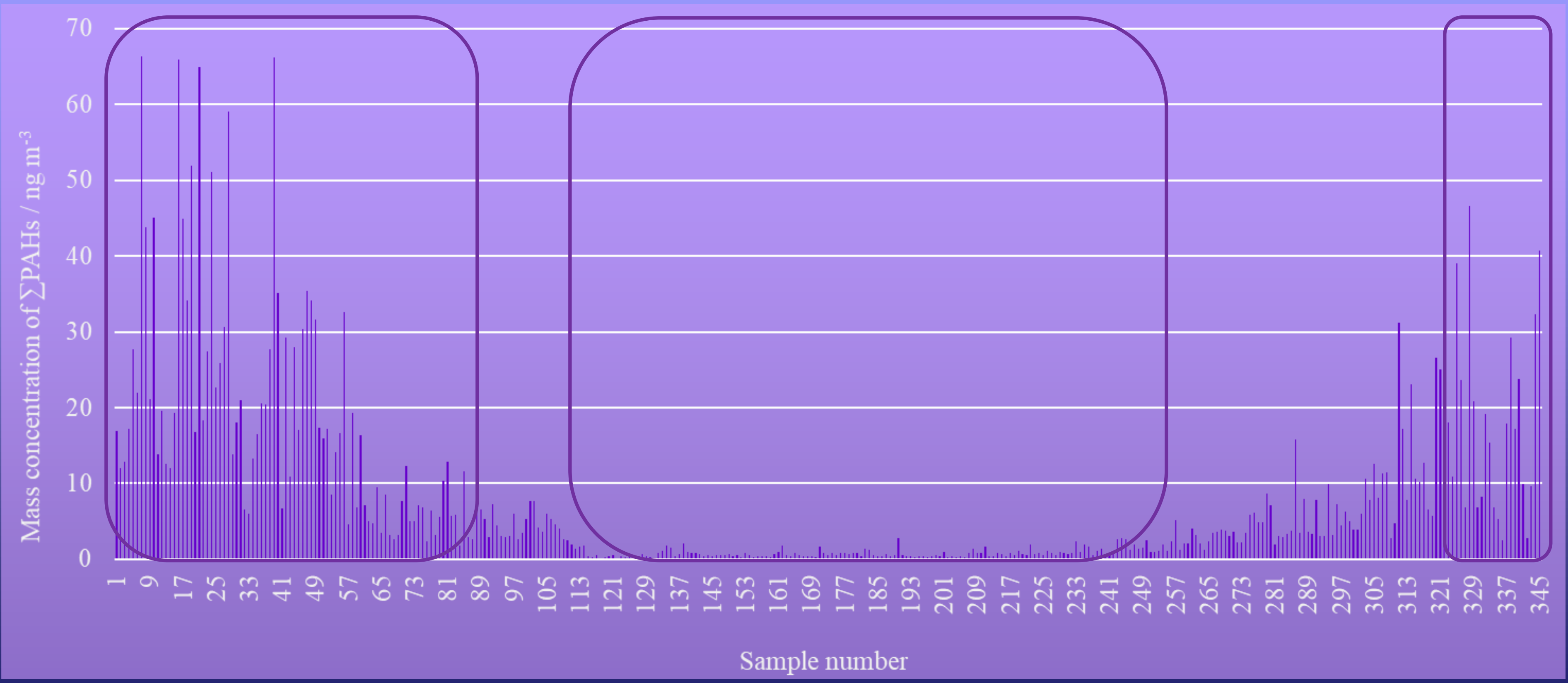


Figure 1. Day to day variations of mass concentration of ∑PAHs

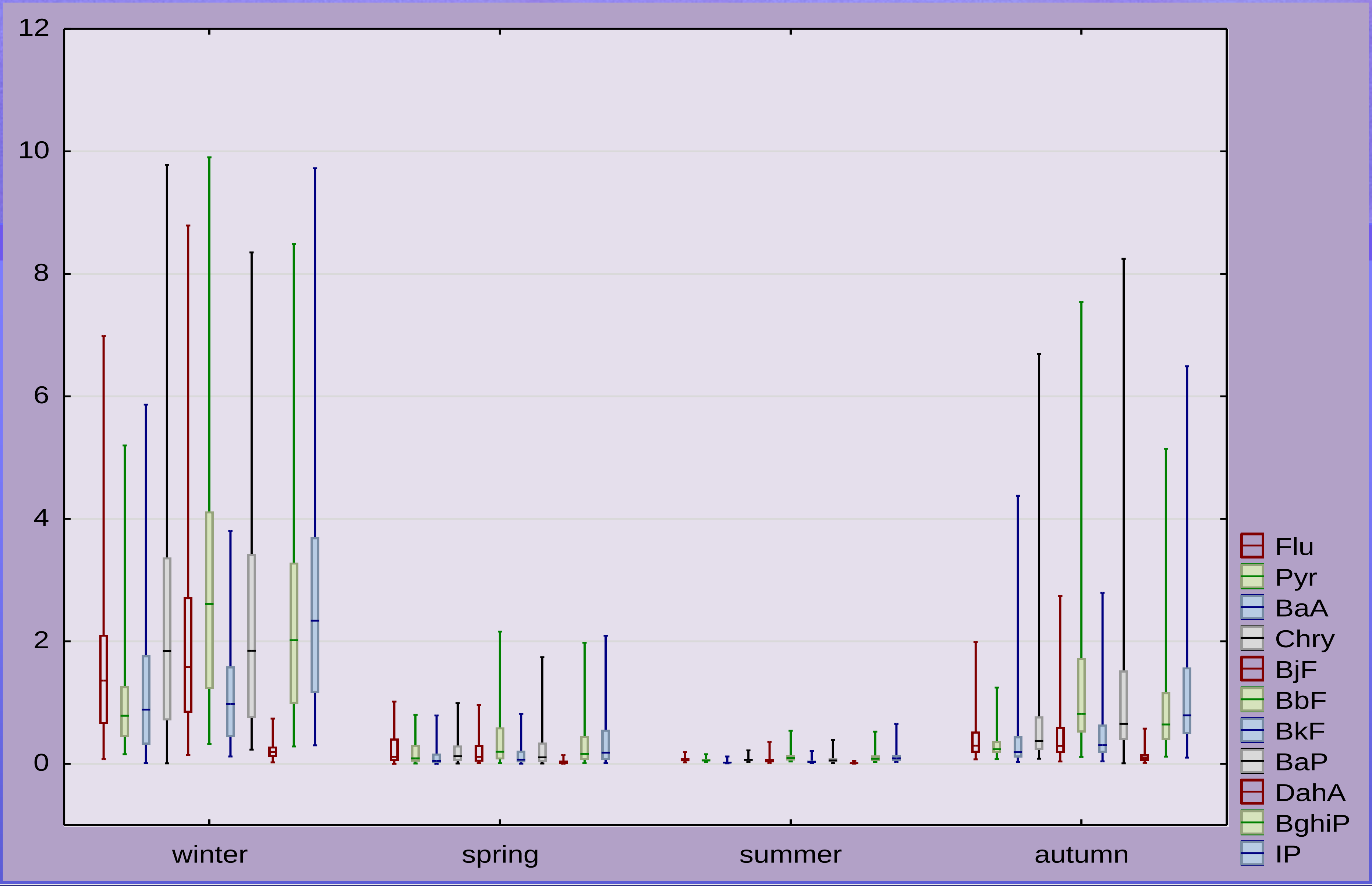


Figure 2. Distribution of PAHs concentrations in seasons

Box-and-Whisker plots showing the distribution of PAHs concentrations in seasons. The boundaries of box-plots indicate the 25th and 75th percentiles; the line within the box is the median value; whiskers above and below the box indicate maximum and minimum

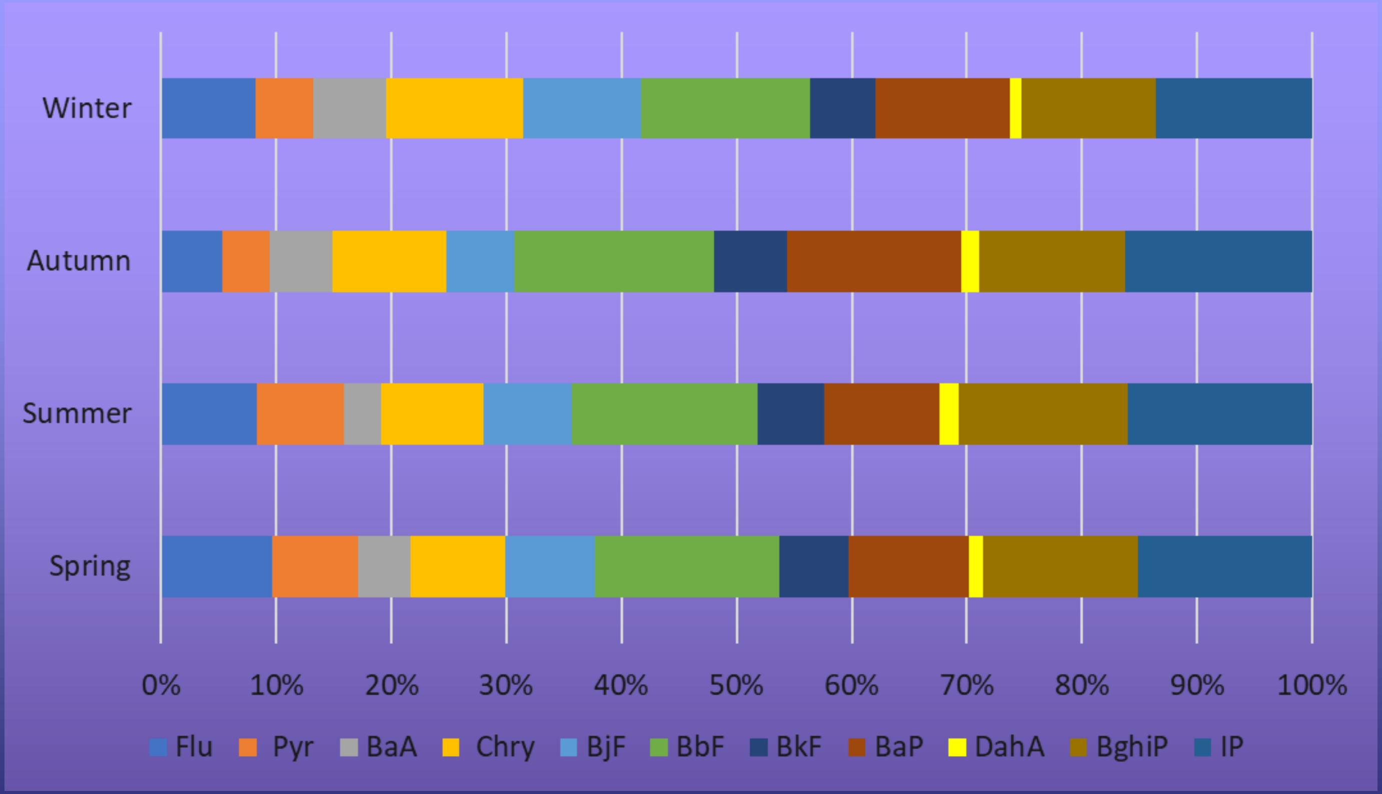
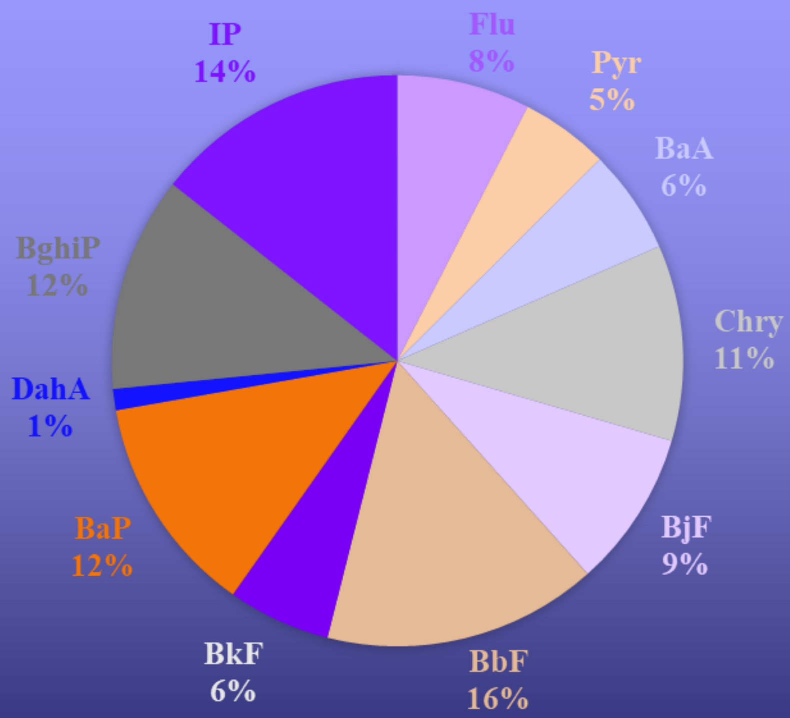


Figure 3. Contribution of individual PAH in total measured PAHs during four seasoms

a)



b)

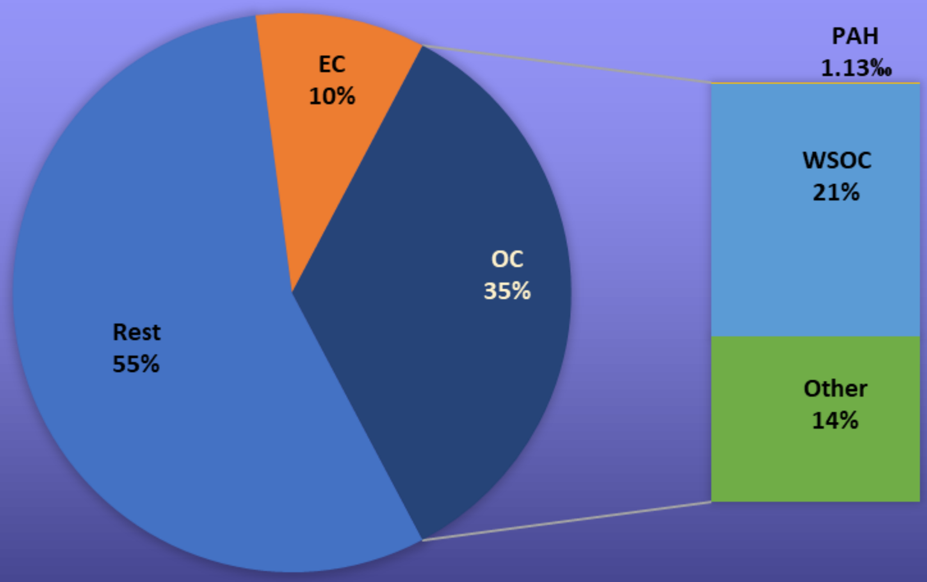


Figure 4. Overall contribution of: a) individual PAH in total measured PAHs b) OC, EC, WSOC and ∑PAH in PM_1 particle fraction

Conclusion

The PAH concentrations winter and autumn ↑

summer and spring ↓

During the cold period the highest mass concentrations was measured for BbF, while during the warm period that was for IP and BghiP

DahA had the lowest mass concentrations during the all seasons of the year

IP, BghiP, BbF, BaP and Chry had the highest contribution in total measured PAHs
This PAHs were indicator for car exhaust emission

Organic pollutants contributed with 35 % in PM_1 particle fraction

Total polycyclic aromatic hydrocarbons in organic carbon contributed with 1.13 ‰

Thank you!!!