UNIVERSITY OF HELSINKI

LOMONOSOV MOSCOW STATE UNIVERSITY

Russian MegaGrant “Megapolis – heat and pollution island”

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WP 2. Daily and seasonal aerosol dynamics in urban air

- Task 2.1 Measurement of the physical-chemical properties of urban aerosols
- Task 2.2 Study of aerosols formation and transport in urban boundary layer

Deliverable 1 - The observational network to provide continuous information on long-term trends in aerosols in Moscow urban atmosphere

Deliverable 2 -
- Transportation and accumulation of aerosols of various origins in a wide range of sizes from nano- to microparticles.

Plan of 1 - st year project

- **expansion of the size range below 300 nm to 5 nm by installation of a nanoparticle spectrometer compatible with OPC**
- Continuous measurements of particle number in a range of size distribution from **ultrafine nanoparticles up to microparticles**
- **AEROSOL CHEMICAL CHARACTERIZATION. Polyaromatic hydrocarbons (PAH)**

Developing Atmospheric Division of

Laboratory of Urban Environment and Climate with state-of-the-art observational capacity

Automatic Sampler PNS

LVS sampler

Optical particle counter
> 300 nm – 10 µm

Aethalometer AE33

Impactor
180 nm – 10 µm
Moudi 100NR

Neutral cluster and Air Ion Spectrometer

NAIS

Diffusion Mobility Particle spectrometer

DMPS
5 nm – 10 µm

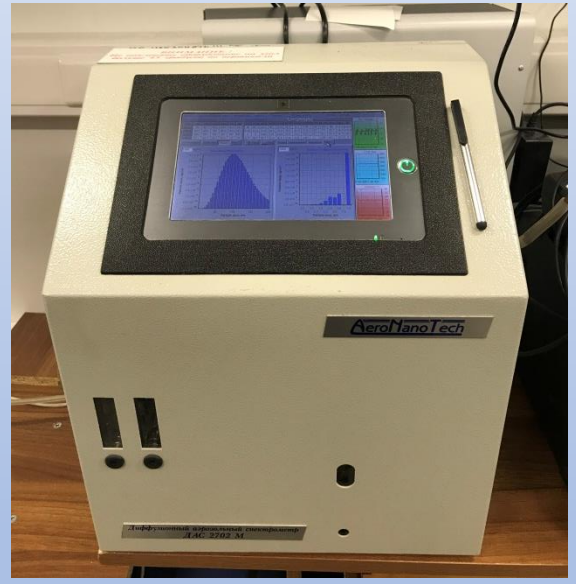
TSI Optical particle counter 3330, 300 nm – 10 µm

below 300 nm to 5 nm

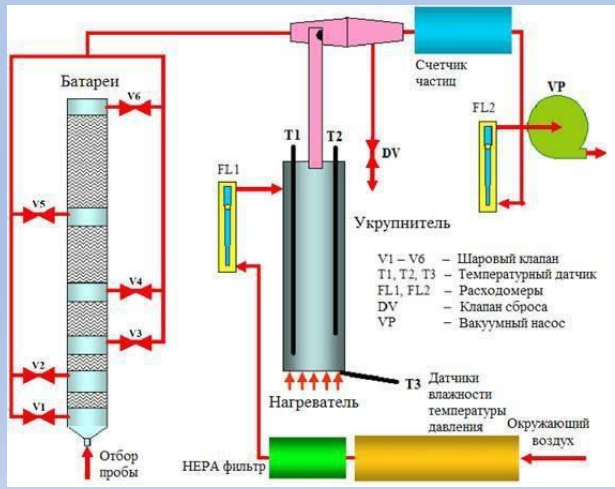
Nanoparticle spectrometer

DIFFUSION AEROSOL SPECTROMETER is installed in May 2021 and continuously operates

Sampling at cold condition?!



It includes:
(i) a block of diffusion batteries,
(ii) CPC module for growing the particles passing through the diffusion batteries up to optically distinguishable sizes
(iii) the laser aerosol spectrometer, which counts amplified particles

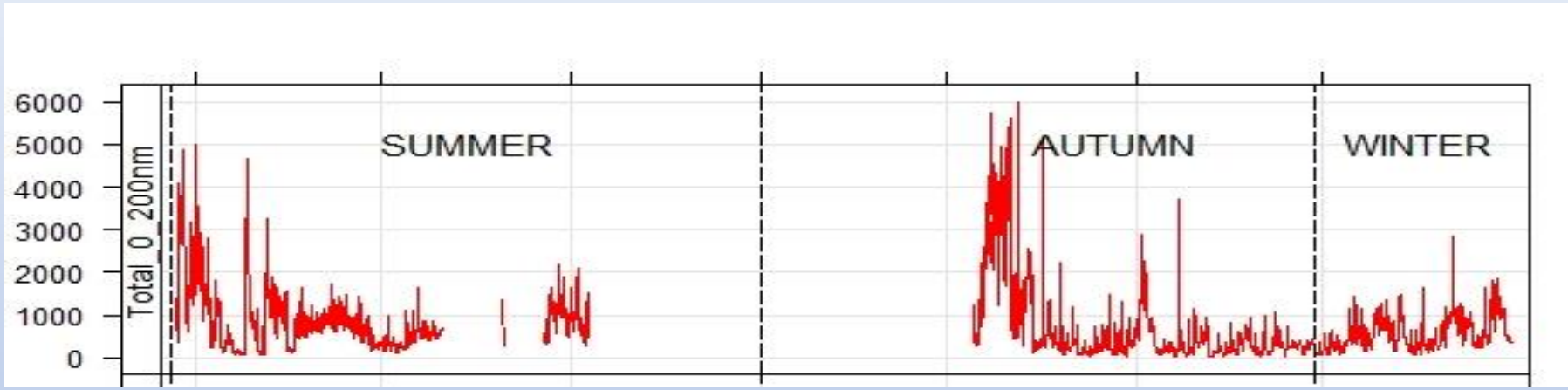


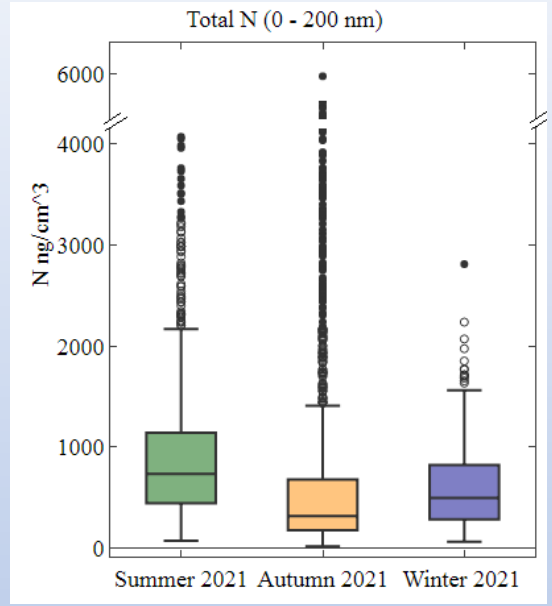
Size range: **5-10 000 nm**
(5-200 nm) (200 nm – 10 000 nm)

- Concentration limit: 100 000 particles per $см^3$
- High resolution data: up to 409 channels

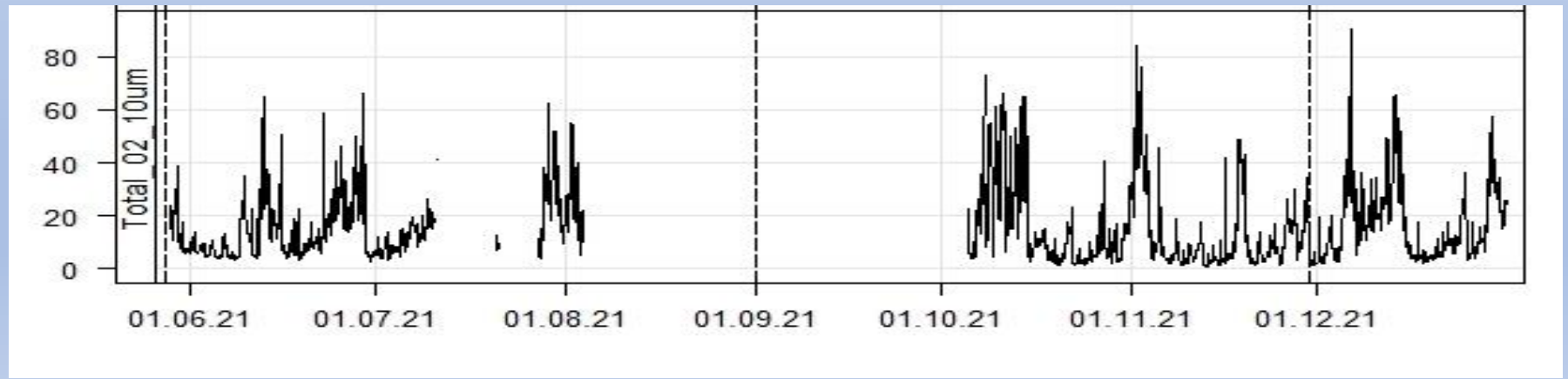
Continious measurements in a range of size distribution from ultrafine nanoparticles up to microparticles.

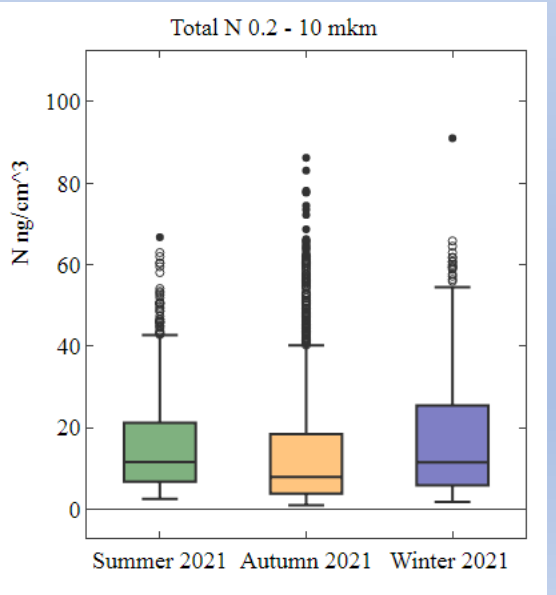
Particle number in a range 0 - 200 nm





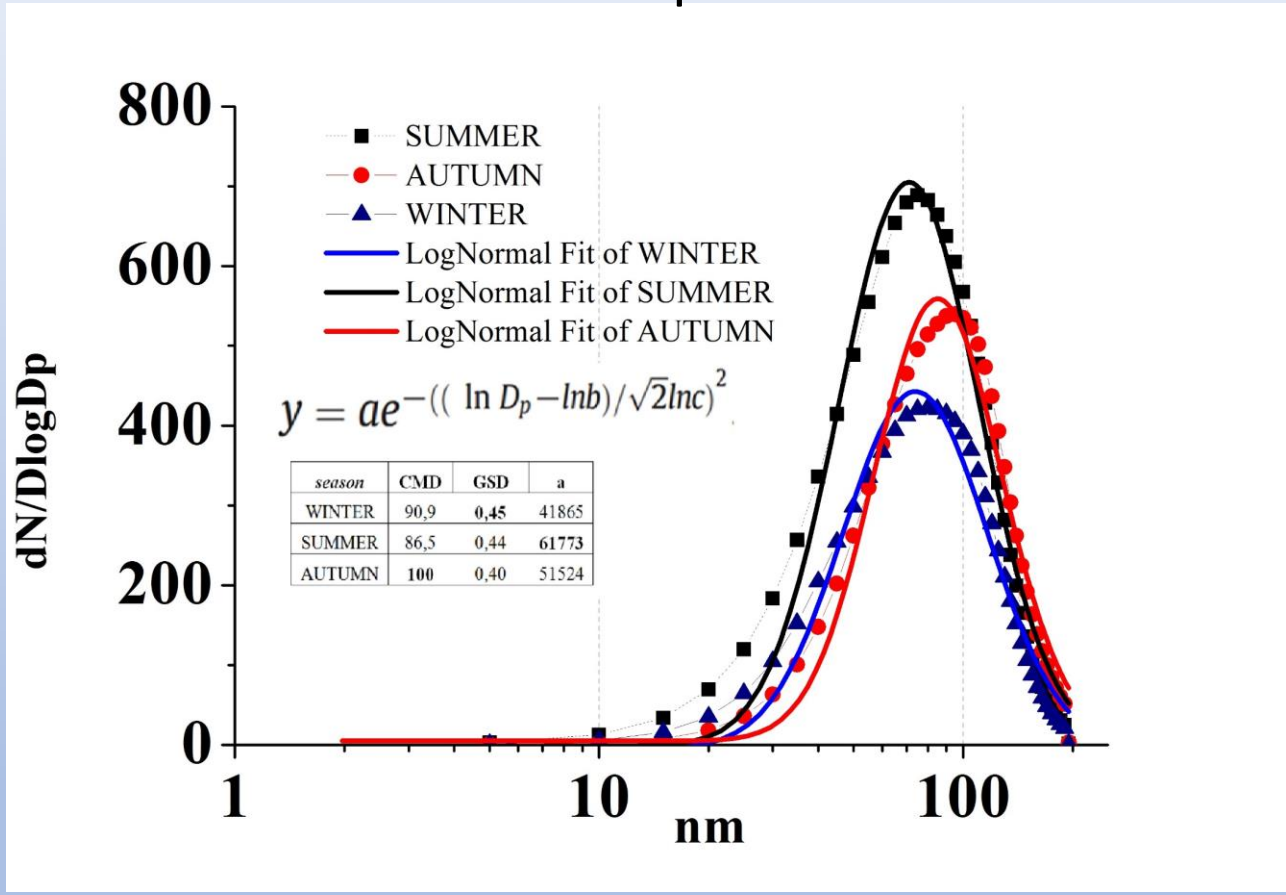
in coarse range 0.2 – 10 μm





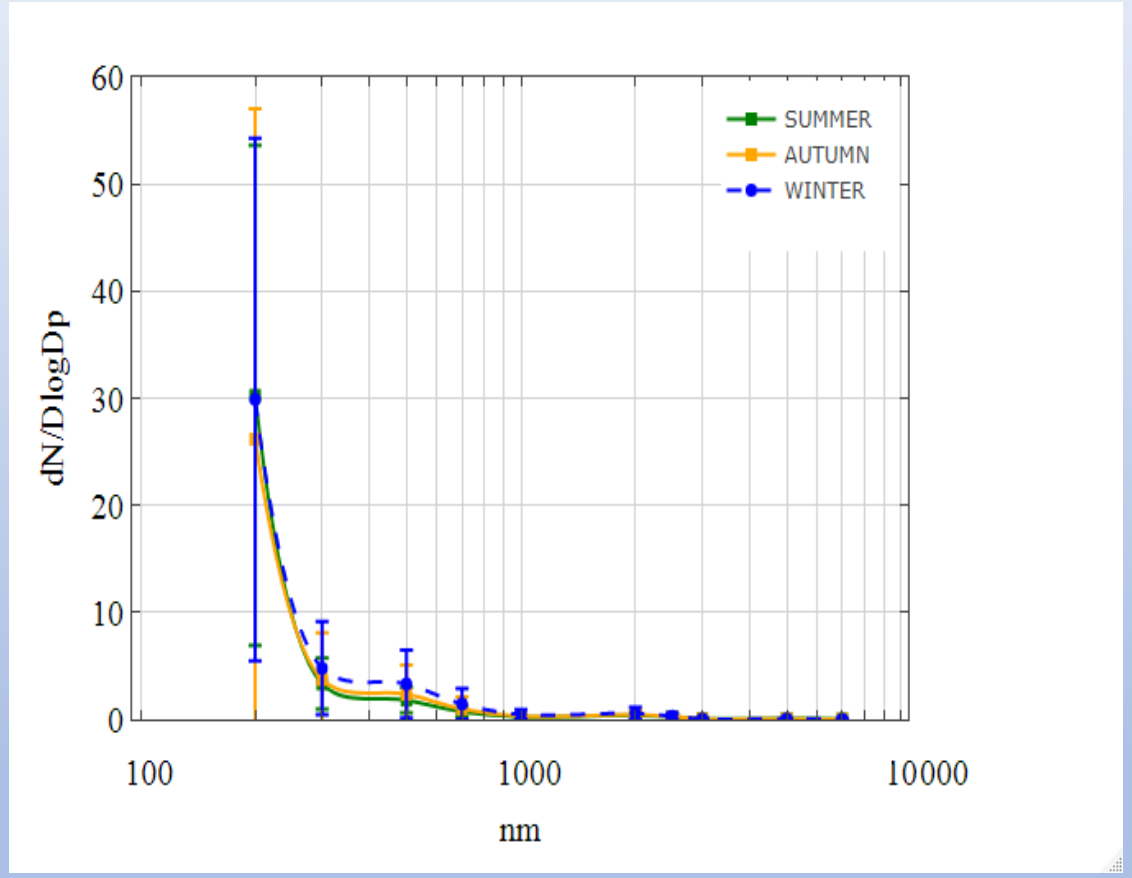
Aerosol number size distribution

Nanoparticles

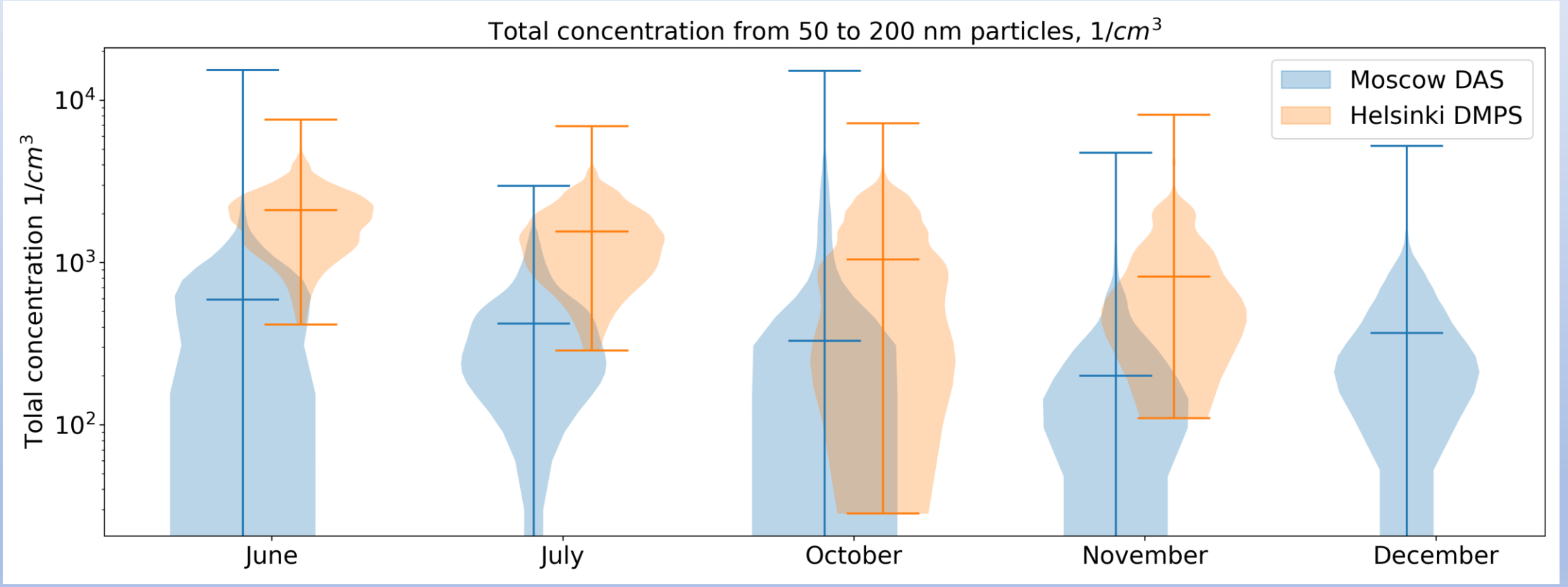


season	CMD	GSD	a
WINTER	90,9	**0,45**	41865
SUMMER	86,5	0,44	**61773**
AUTUMN	**100**	0,40	51524

Coarse particles



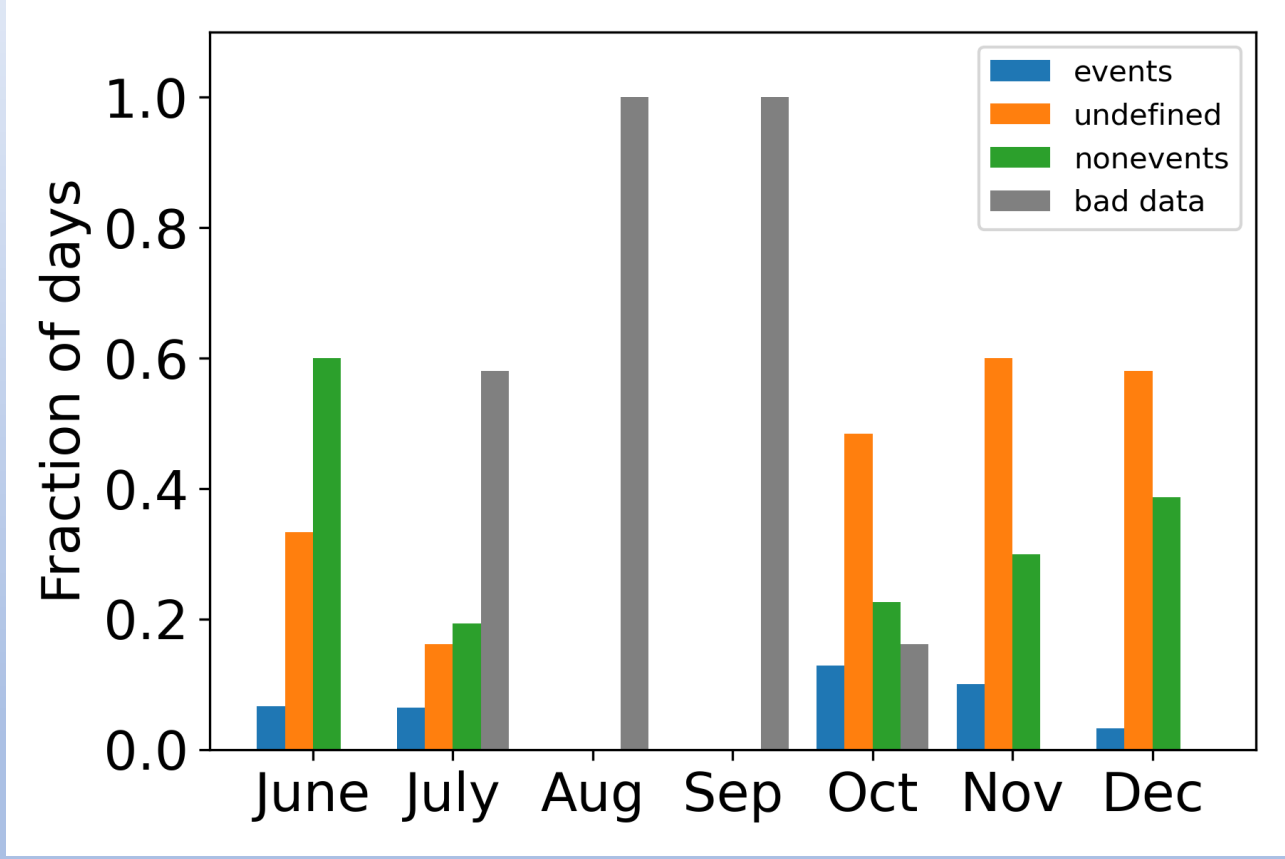
Comparison of total concentrations of particles from 50 nm to 200 nm from Moscow DAS and Helsinki DMPS (Demarkova A.)



Where DMPS takes place in Helsinki ? Site should be described . SMEAR III station in Helsinki, Kumpulan campus ? Traffic site?
May be picture also?
May be size distribution can be shown?

NPF event classification (Demarkova A.)

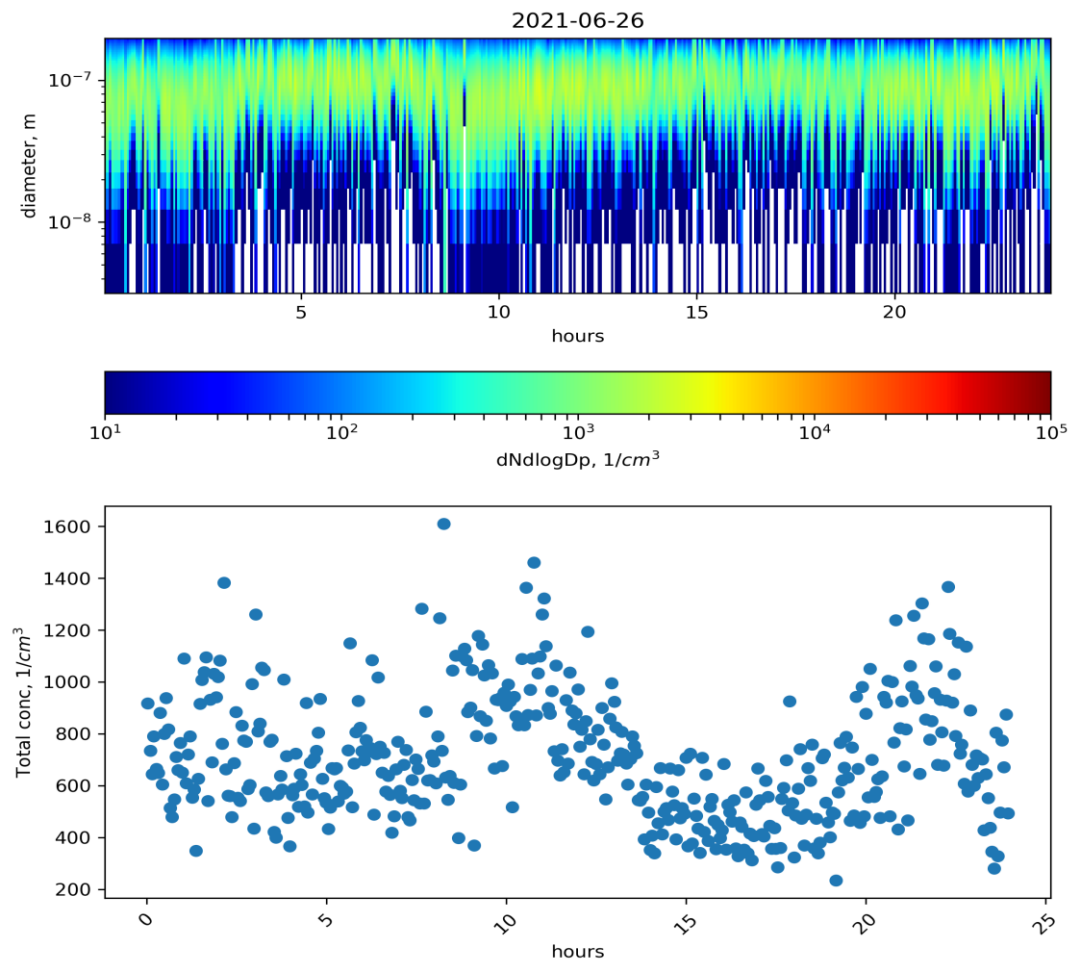
- The number of NPF events is critically low (2 days contained NPF event in June, 2 in July, 4 in October, 3 in November and 1 in December)
- All NPF events in Moscow are weak
- The fraction of undefined days in Moscow is high



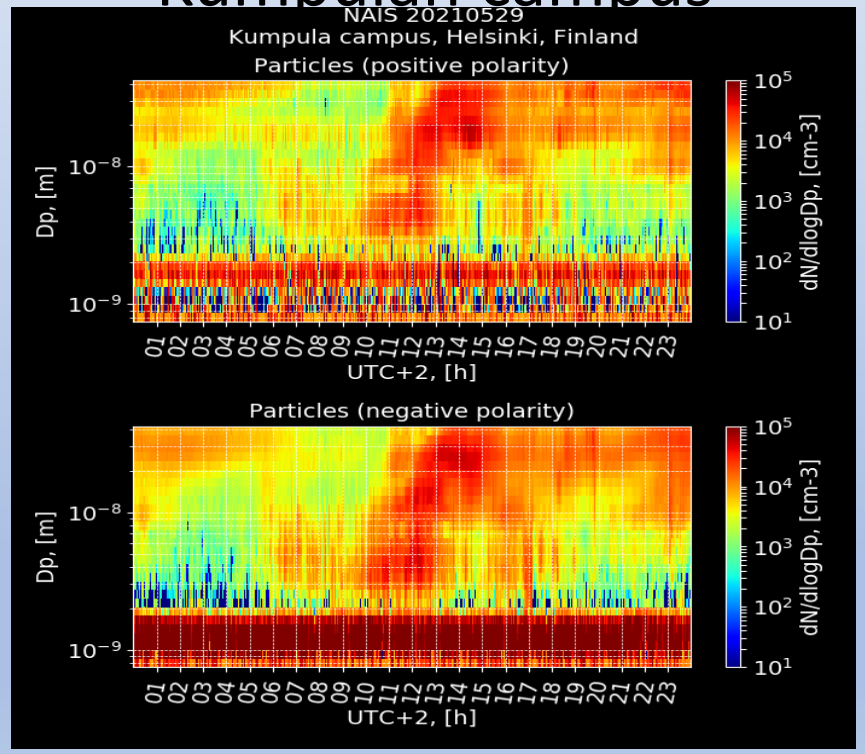
What's is bad data? In grey
I should simply remove august and september from consideration.
What is bad data in July and Oct?

Typical NPF event in Moscow (Demarkova A.)

- Plot shows the NPF event during 26 June 2021.
- All NPF events in Moscow are weak as in presented picture.



For comparison: NPF event at SMEAR III station in Helsinki, Kumpulan campus

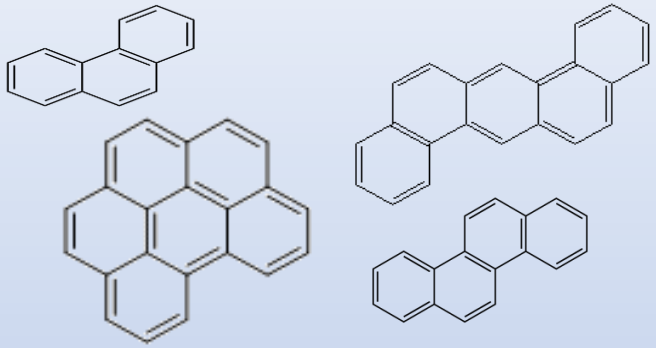


In Helsinki how frequent events? They ate strong? How much stronger than in Moscow?

AEROSOL CHEMICAL CHARACTERIZATION
Seasonal Polyaromatic hydrocarbons (PAH)

phenanthrene
anthracene
fluoranthene
pyrene
benz[a]anthracene
chrysene
benzo[b]fluoranthene
benzo[k]fluoranthene
benzo[a]pyrene
dibenz[a,h]anthracene
benzo [g,h,i]perylene

Analytic tool: GC-MS combined with HPLC

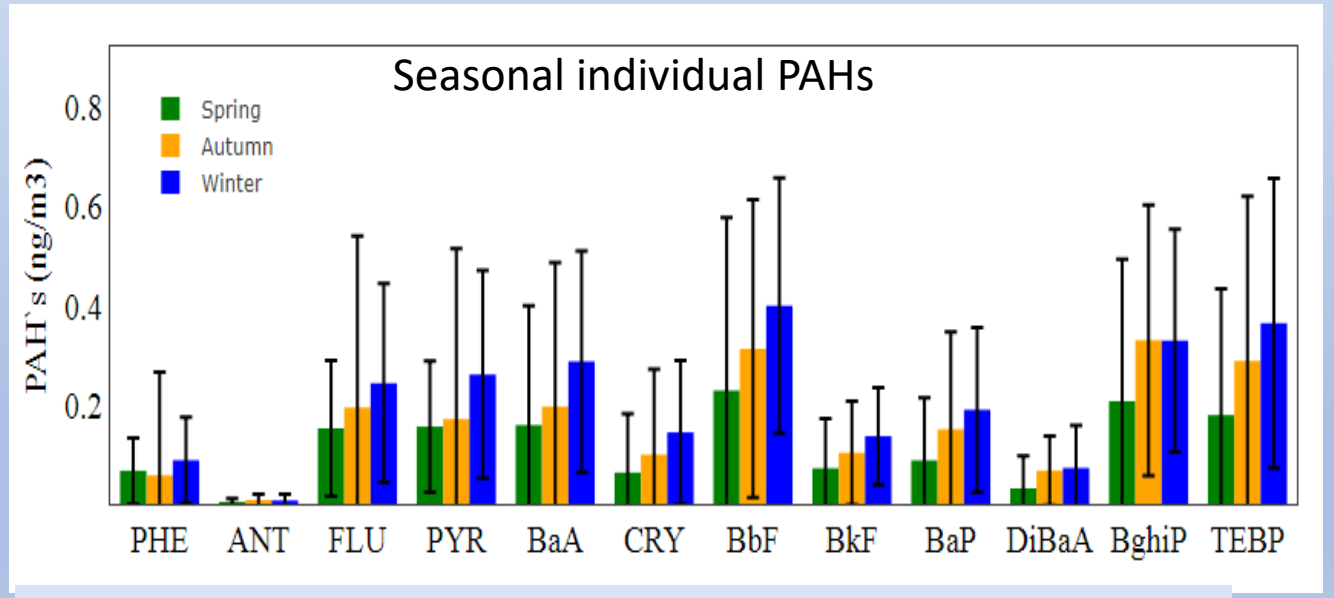


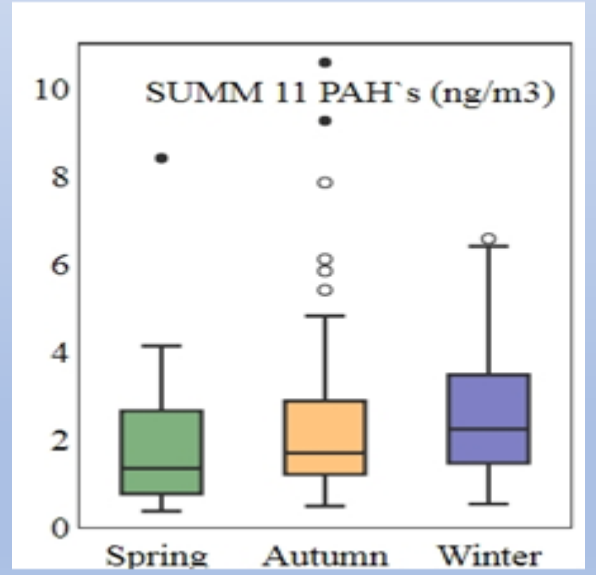
Toxic equivalent

$$TEBP = \sum_i^{11}(\mathrm{C}i \times \mathrm{TEF}i),$$

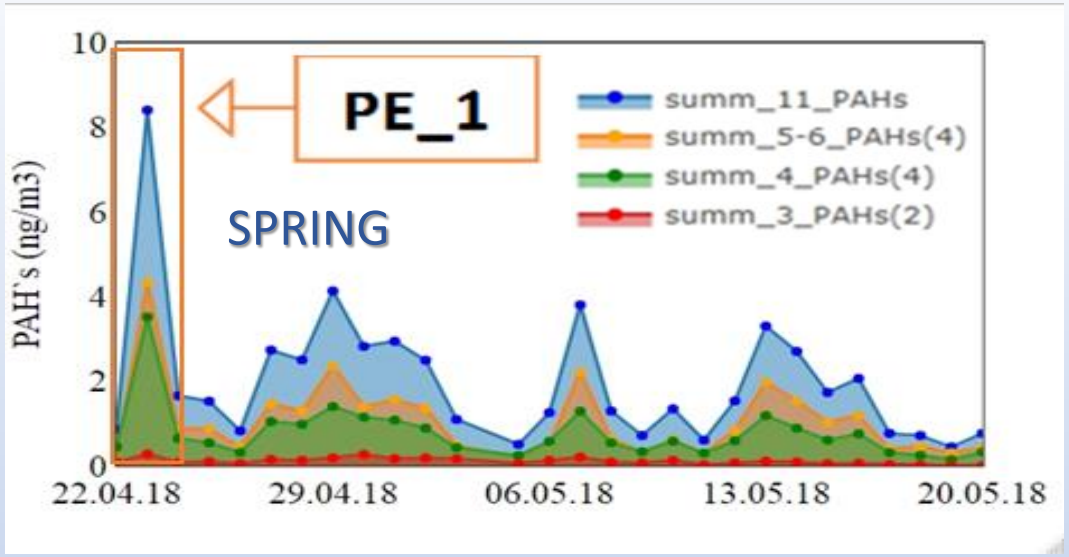
TEFi - toxicity equivalency factor of individual PAH with relevance to benzo[a]pyrene

24 h sampling

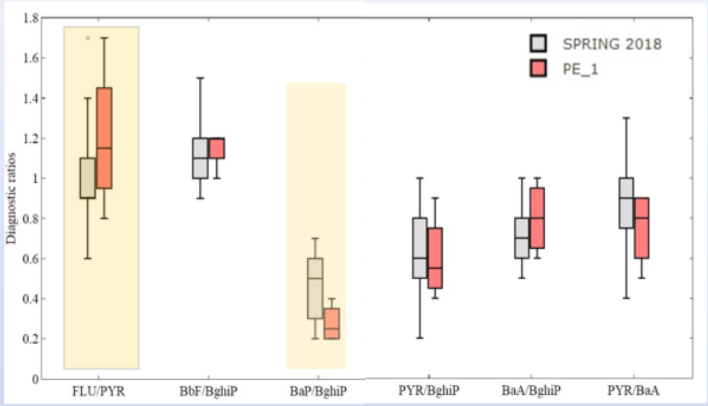




In winter all PAHs concentration and toxic equivalent are the highest



diagnostic relationships

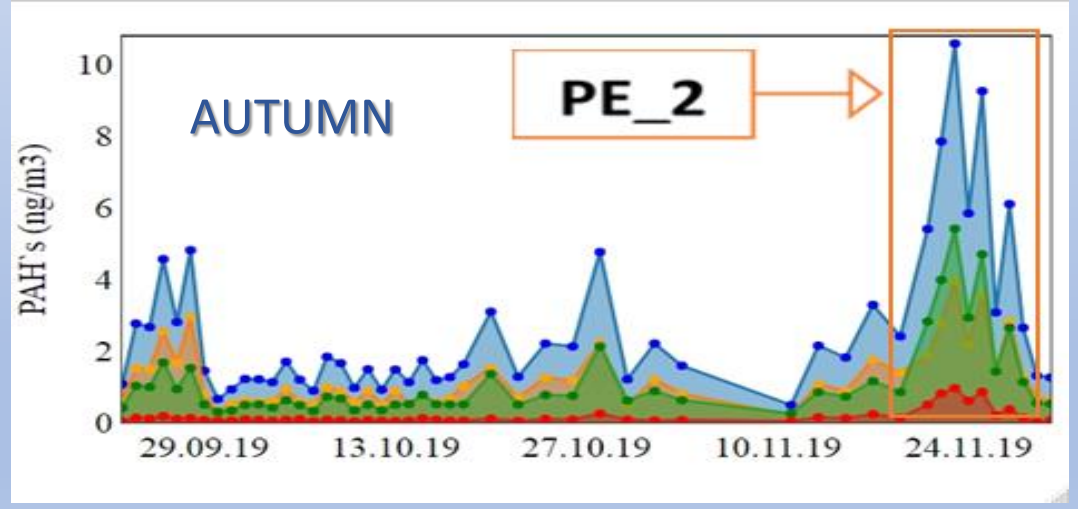


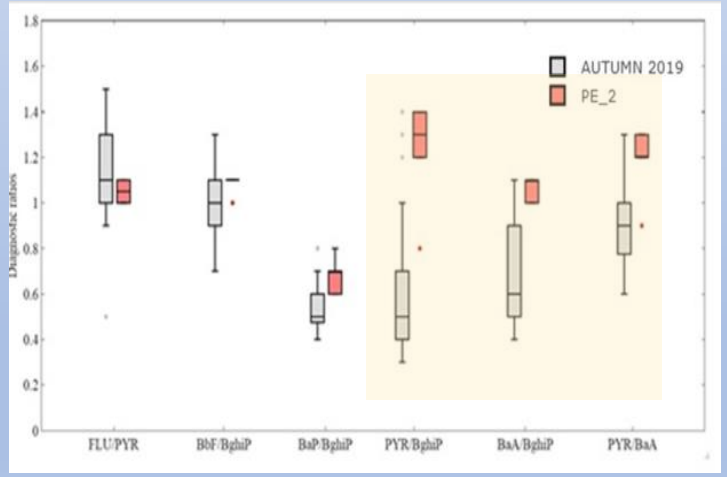
FLU/PYR

BaP/BghiP

Pollution event PE_1

increasing BB impact at dominant traffic





PYR/BghiP

BaA/BghiP

PYR/BaA

Pollution event PE_2

industrial impact with high petrogenic emission