UFIREG

Ultrafine particles – cooperation with environmental and health policy

Air quality in the UFIREG cities

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LANDESAMT FÜR UMWELT, LANDWIRTSCHAFT UND GEOLOGIE

Freistaat SACHSEN

CENTRAL EUROPE COOPERATING FOR SUCCESS.

EUROPEAN UNION EUROPEAN REGIONAL DEVELOPMENT FUND

UFIREG sites

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- Urban background
- Additional data: PM, gases and meteorology
- 80 – 300 m distance to high traffic sites or industry
  - different traffic impact
  - different vehicle fleet
- Country and city specific emissions/traffic regulations

Instrumentation

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SMPS

Highly size resolved

Dresden
Ljubljana
Prague
Chernivtsi

TDMPS

Augsburg

UFP 330

UFIPOLNET

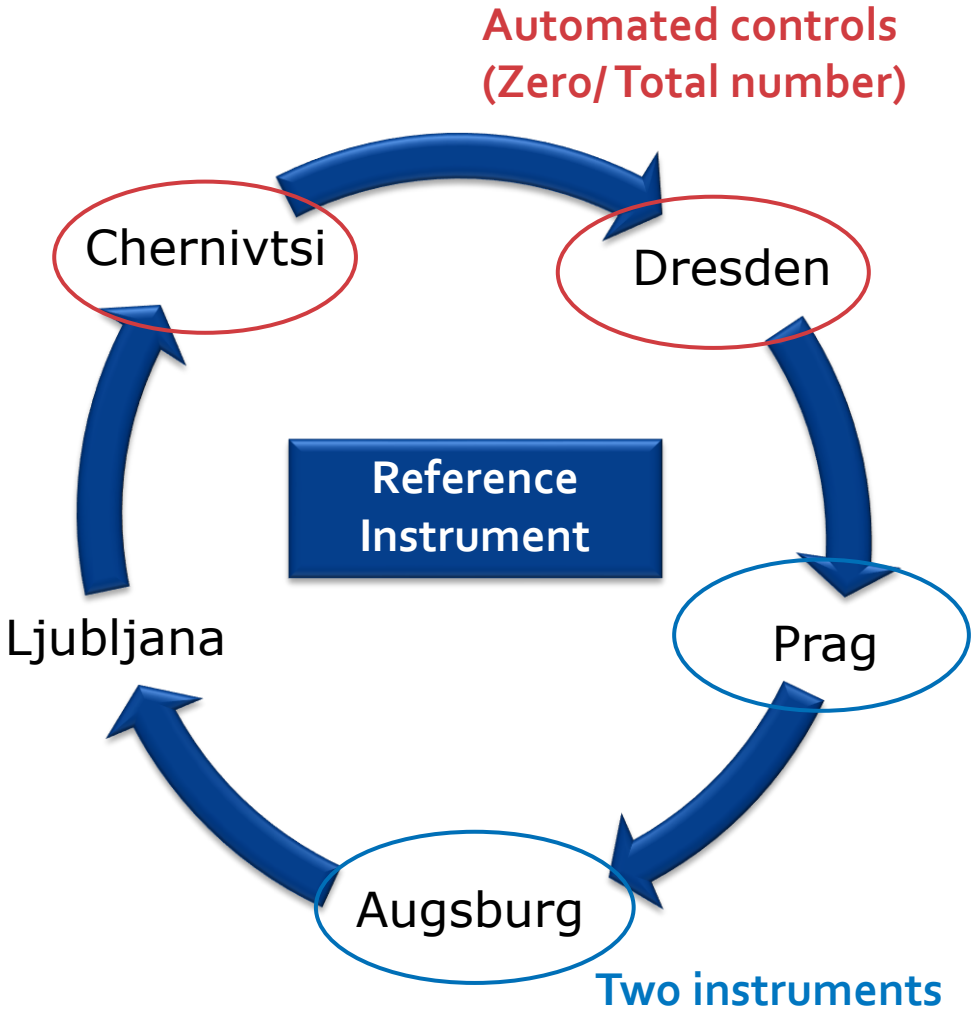
Five size classes

Augsburg
Prague

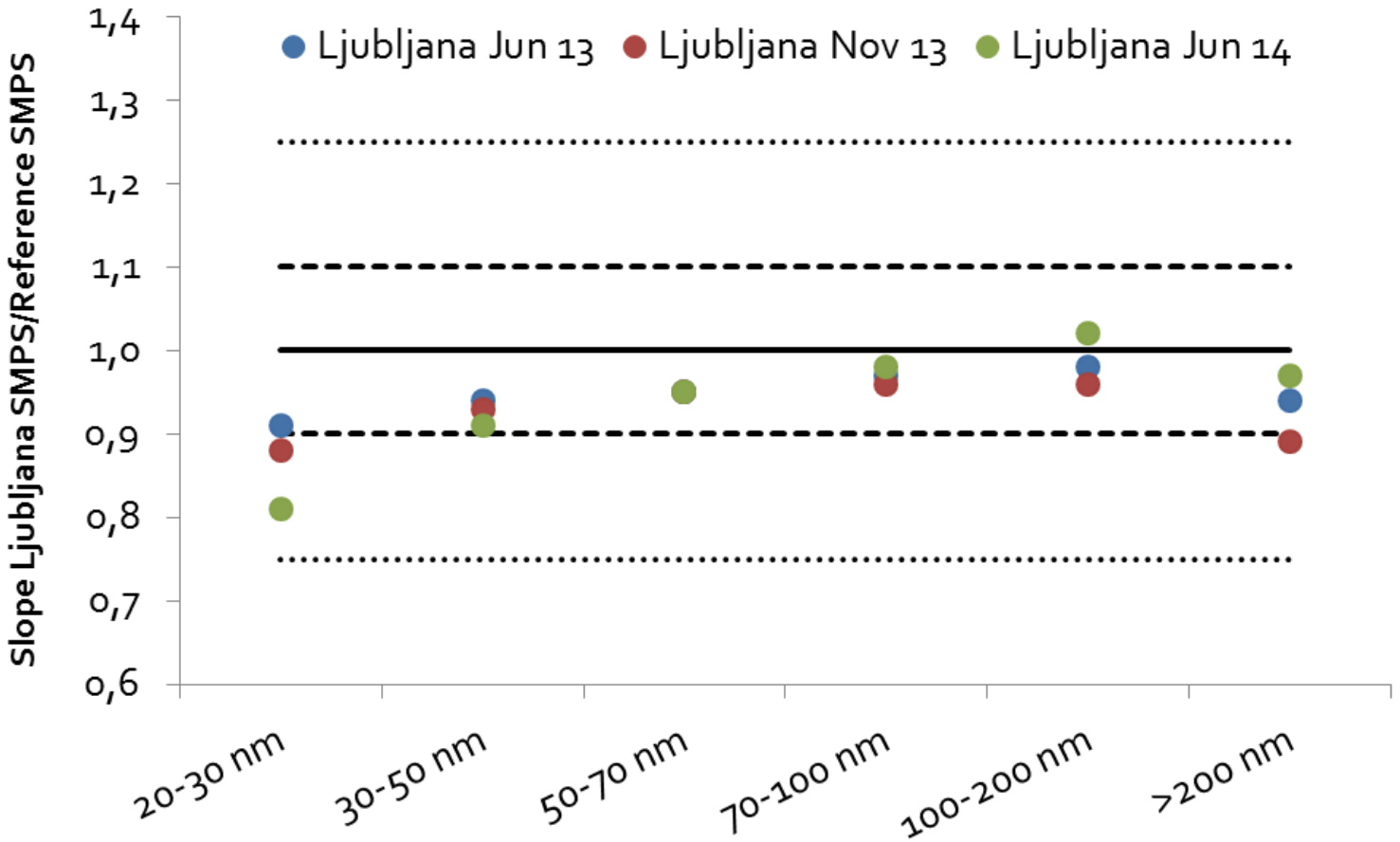
Pictures: M. Merkel, T. Kusch

Quality assurance

- Theoretical and practical training
- Initial intercomparison
- Remote monitoring
- Automated function controls
- Parallel operation of instruments
- Frequent on-site comparisons



On-site comparisons - Ljubljana



Challenges in measuring UFP/PNC

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- Still relatively new measurement technique
- Little experience in long-term application in routine networks
- Need of very frequent quality assurance
- Complex measurement principle and data validation
- Still high uncertainties (~ 20%), especially in the smallest size range
- Butanol emissions of instruments with condensation particle counters
  - problematic for benzene measurements > can be mitigated by catalytic oxidation

UFIREG air quality data set

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- May 2012 to April 2014:

  Augsburg, Dresden, Ljubljana, Prague

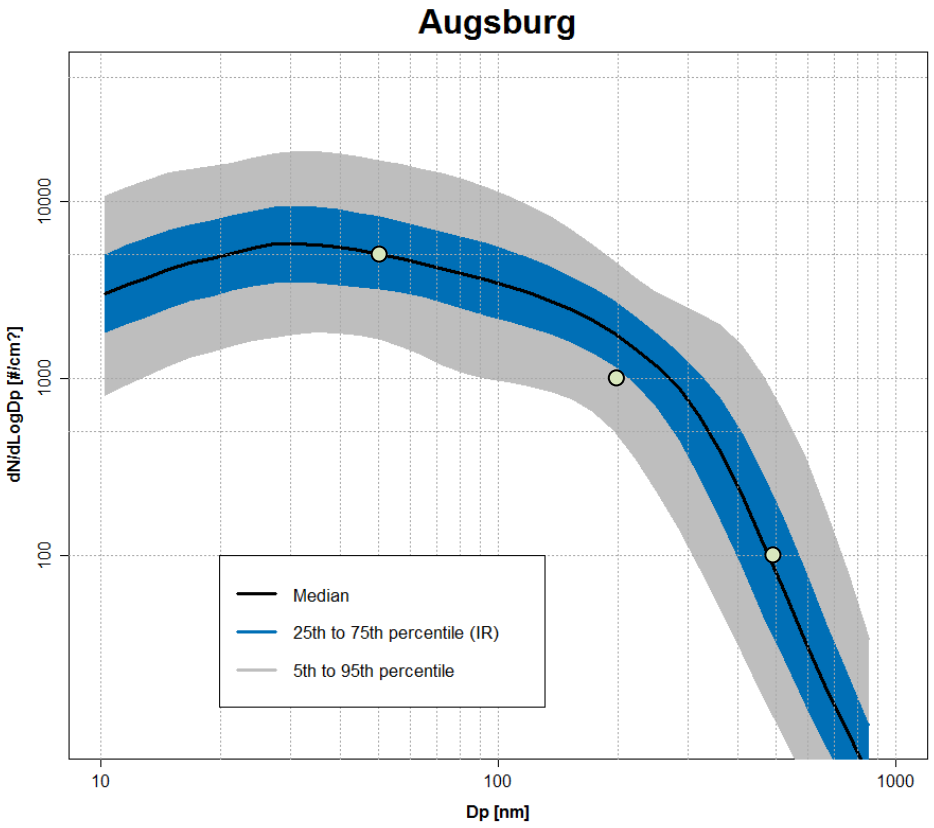
- January 2013 to April 2014:

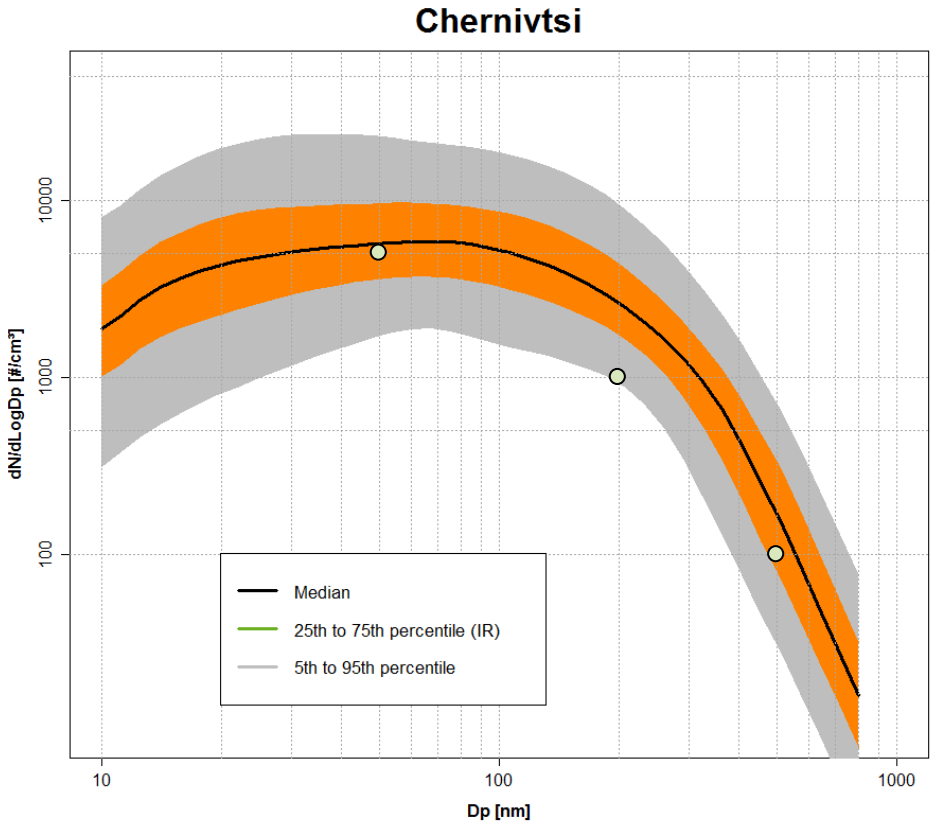
  Chernivtsi

- PSD data (10-800 nm, except Prague: 10-200 nm)
- PNC data in 7 size classes
- Data availability of PNC data:

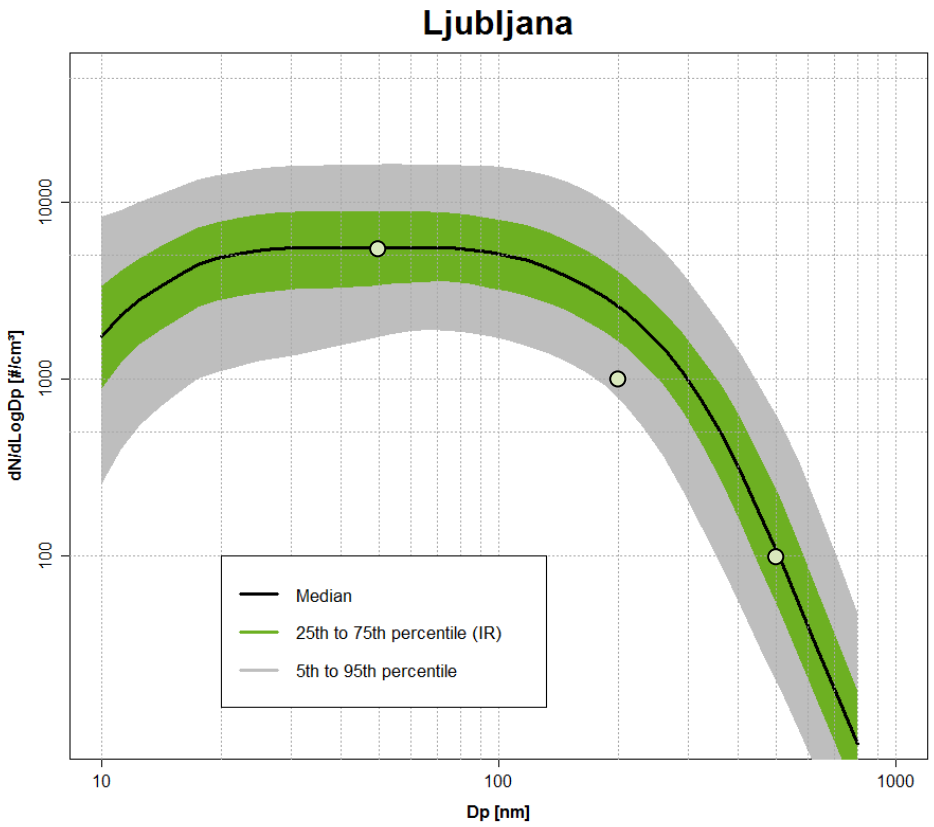
Augsburg	Chernivtsi	Dresden	Ljubljana	Prague
90 %	86 %	88 %	77 %	82 %

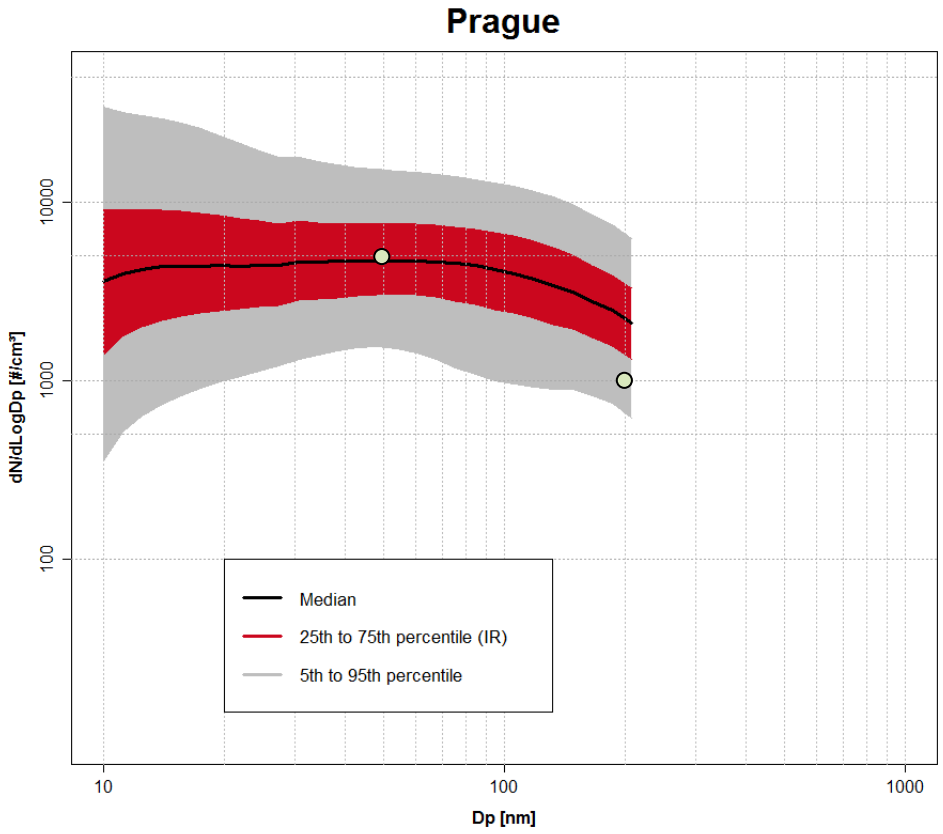
Particle number size distribution





Particle number size distribution





Particle number size distribution

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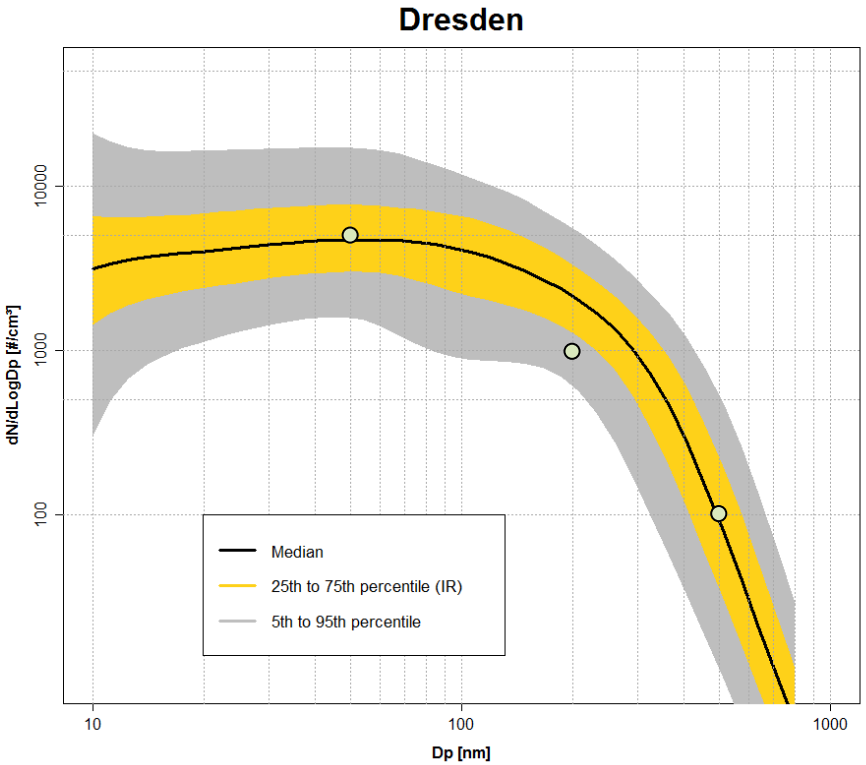
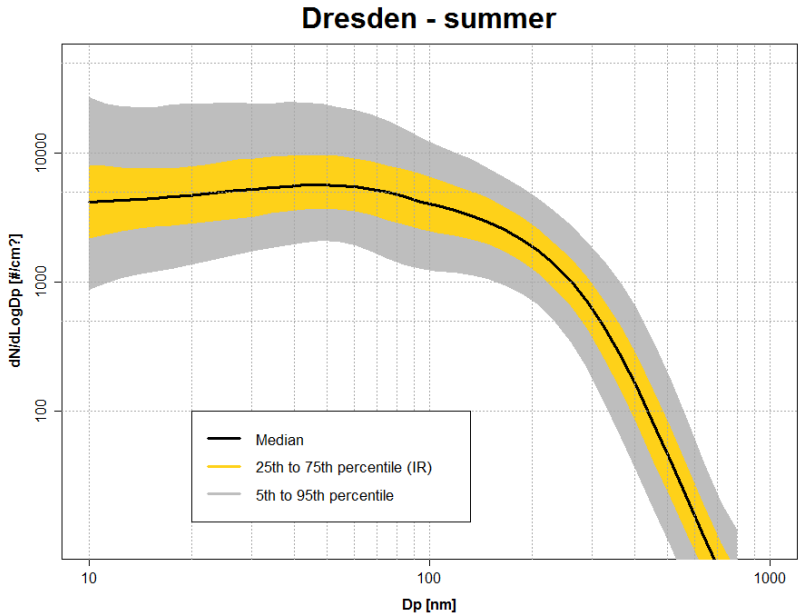
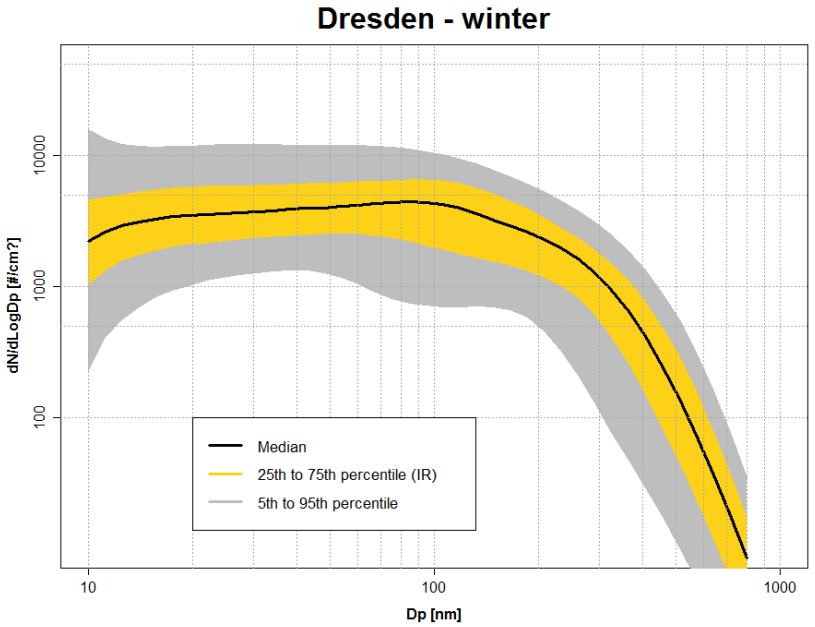
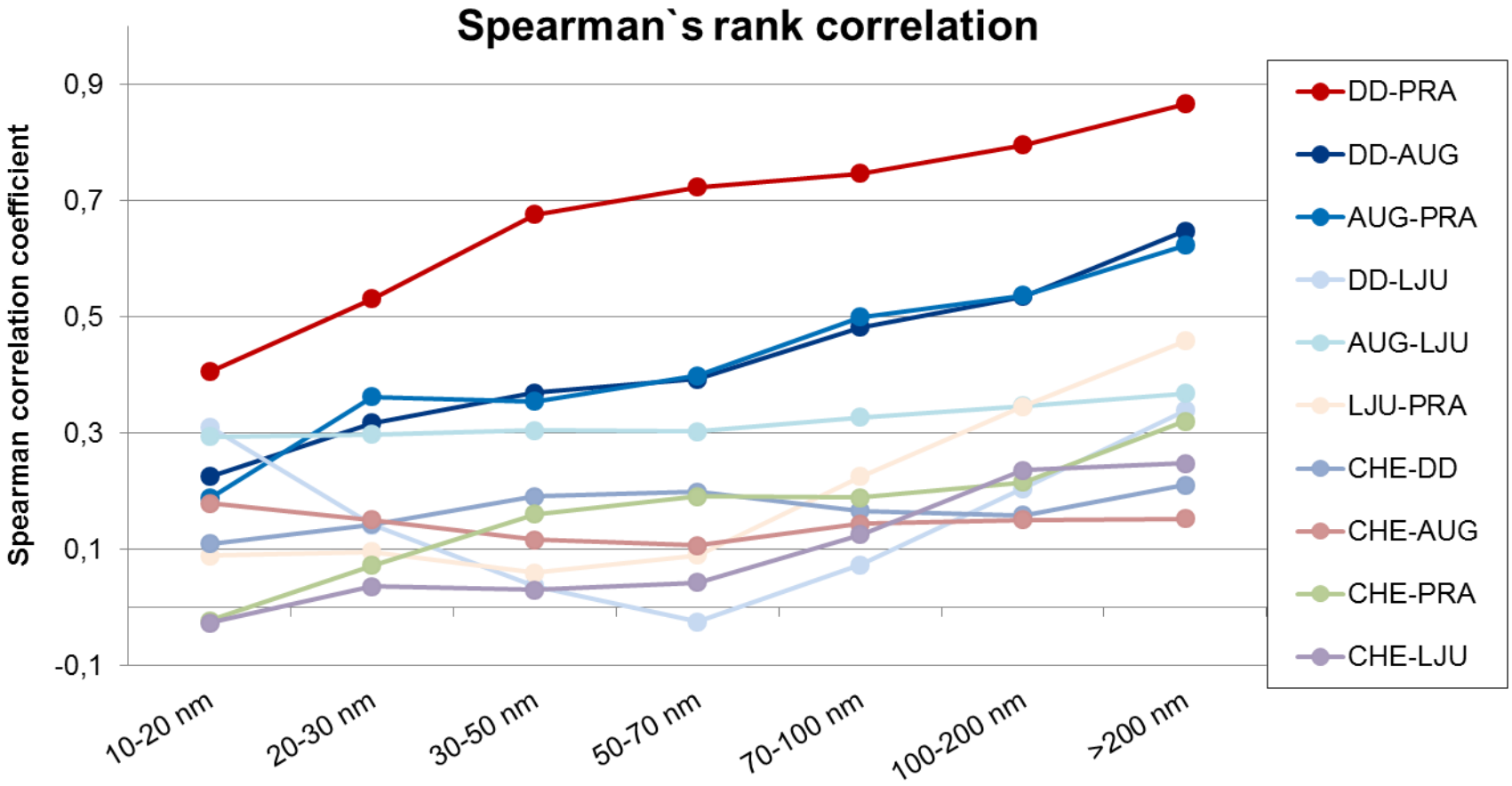


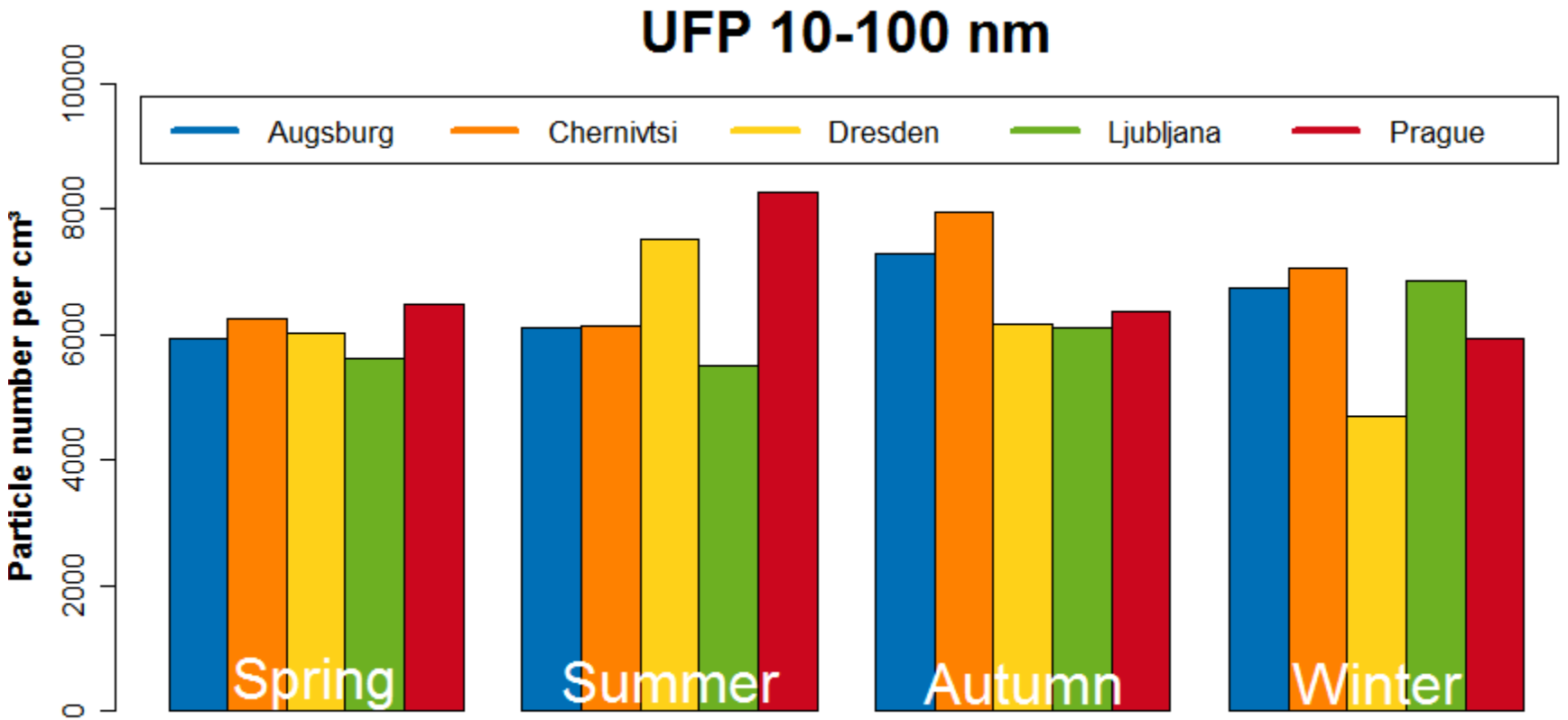




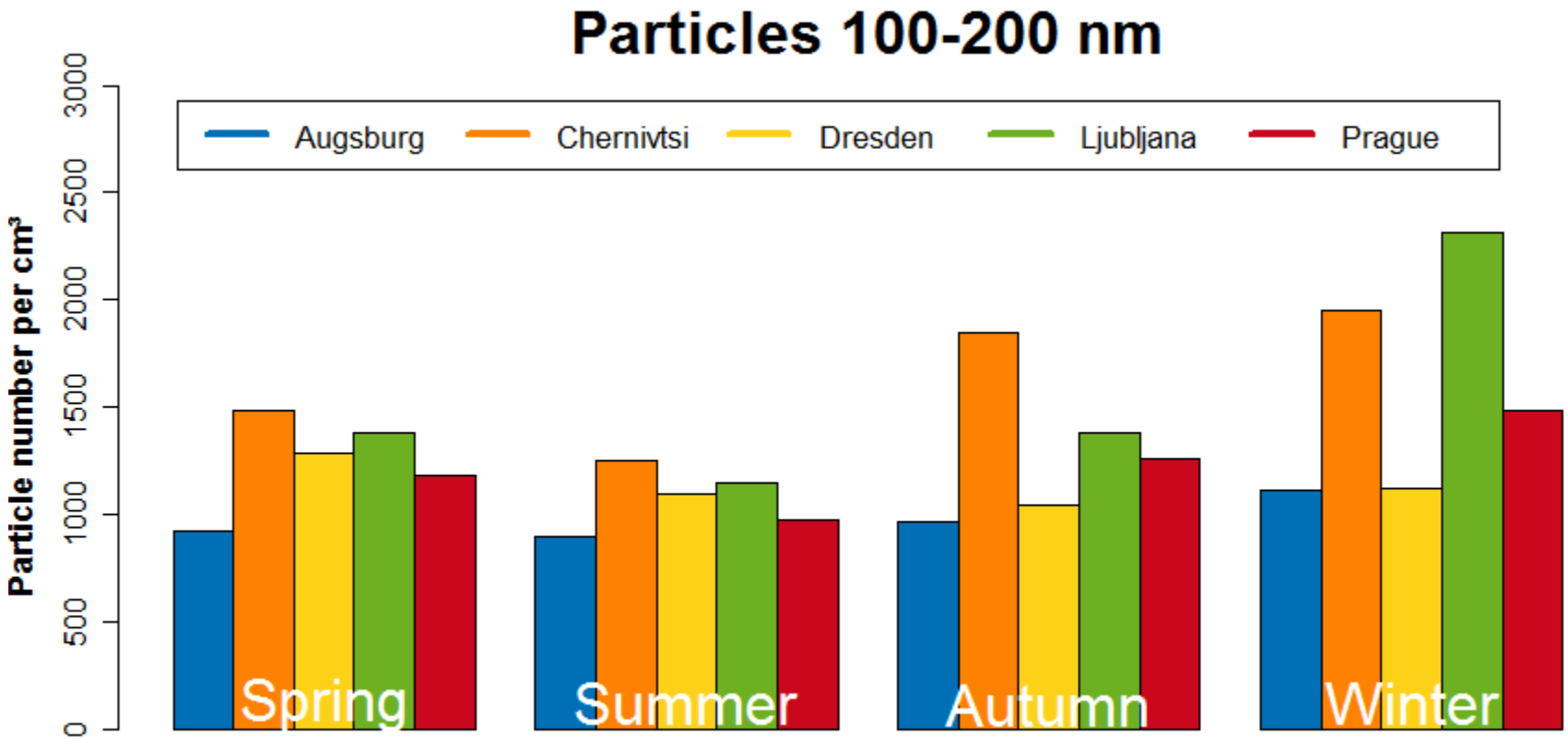
PNC variation between UFIREG sites



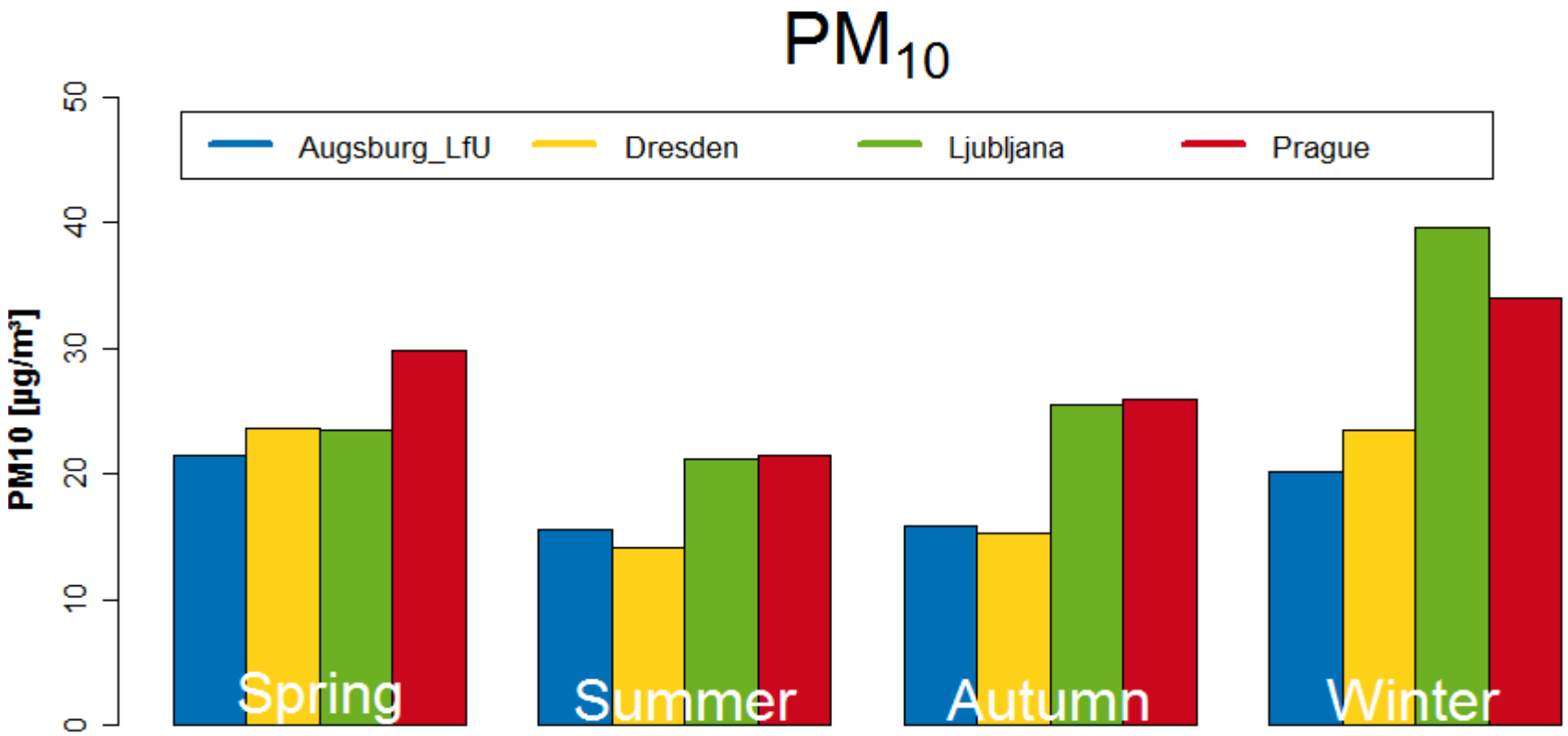
Seasonal variation UFP



Seasonal variation PNC 100-200 nm



Seasonal variation PM10



Monthly variation

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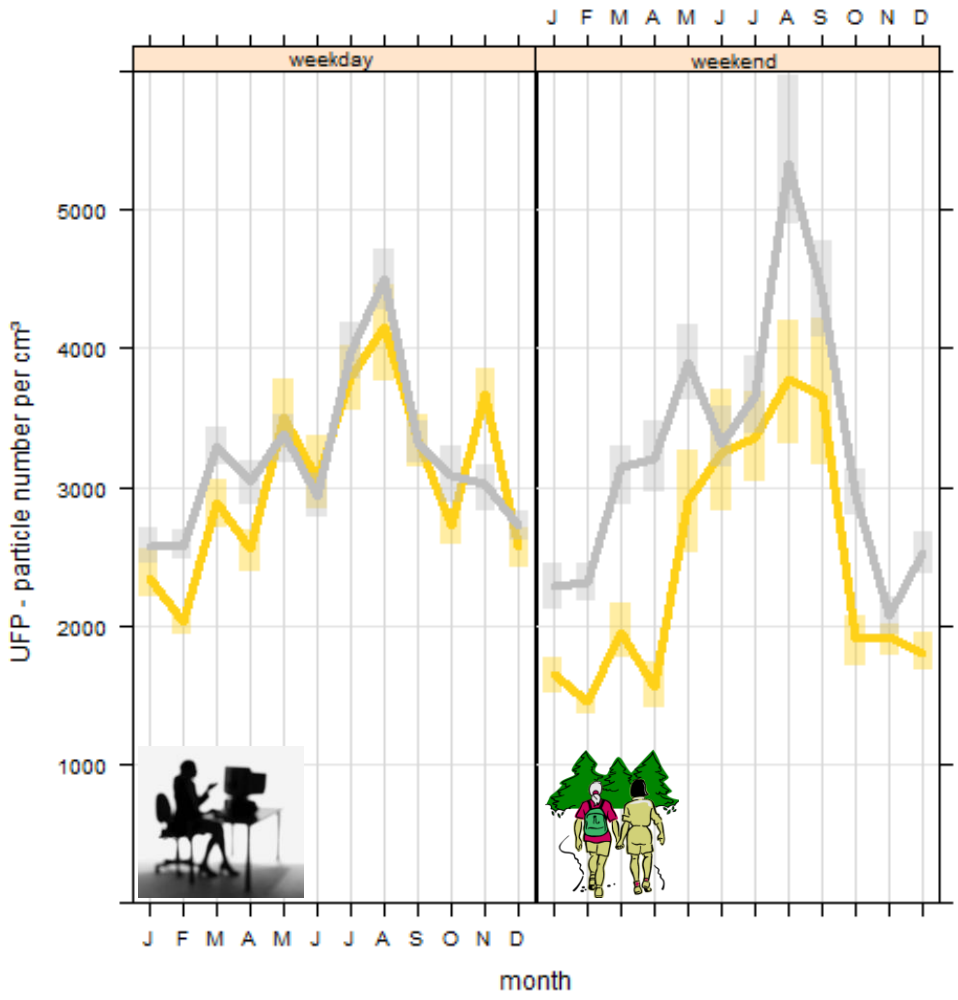
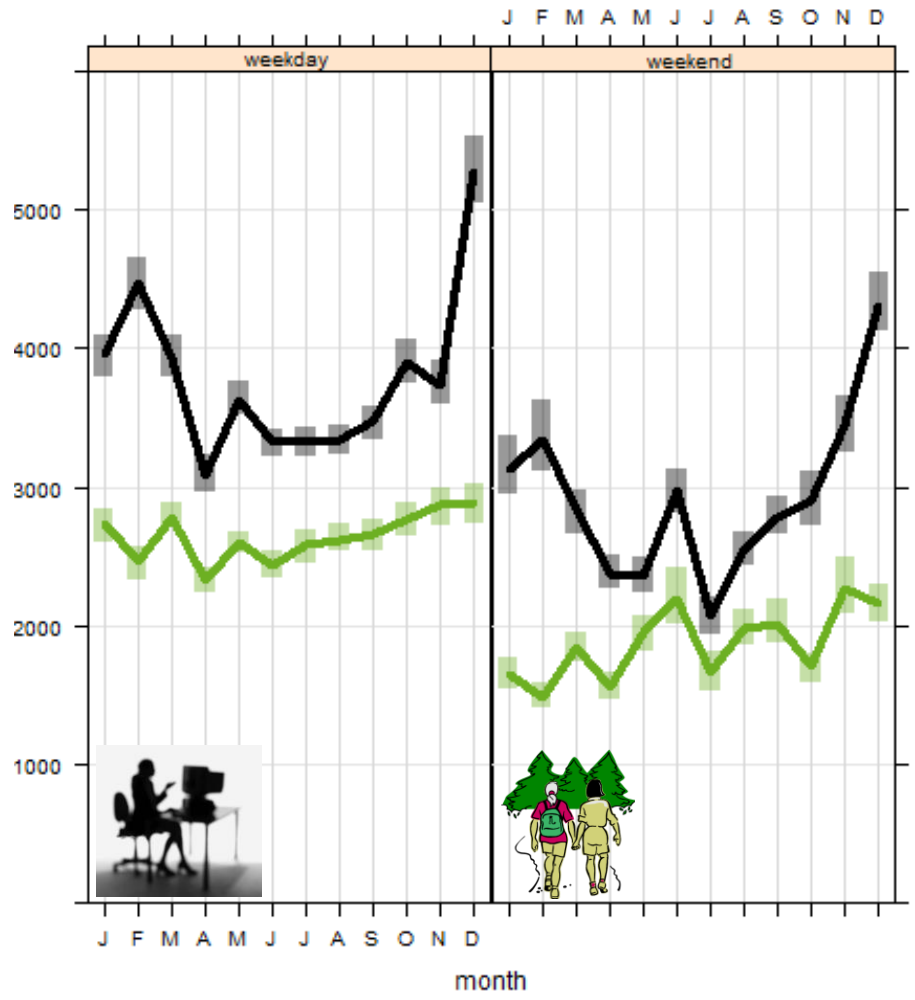
Dresden

10-30 nm 30-100 nm



Ljubljana

10-30 nm 30-100 nm



Diurnal variation

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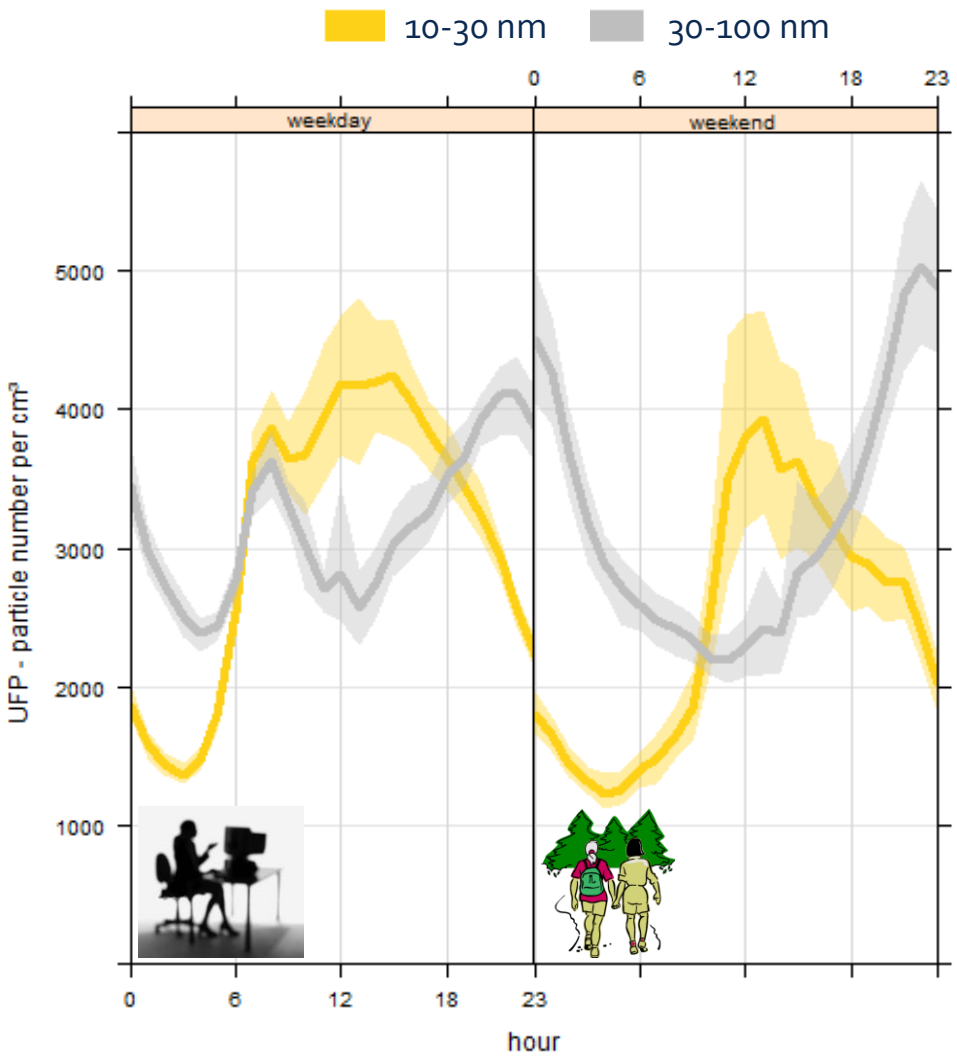
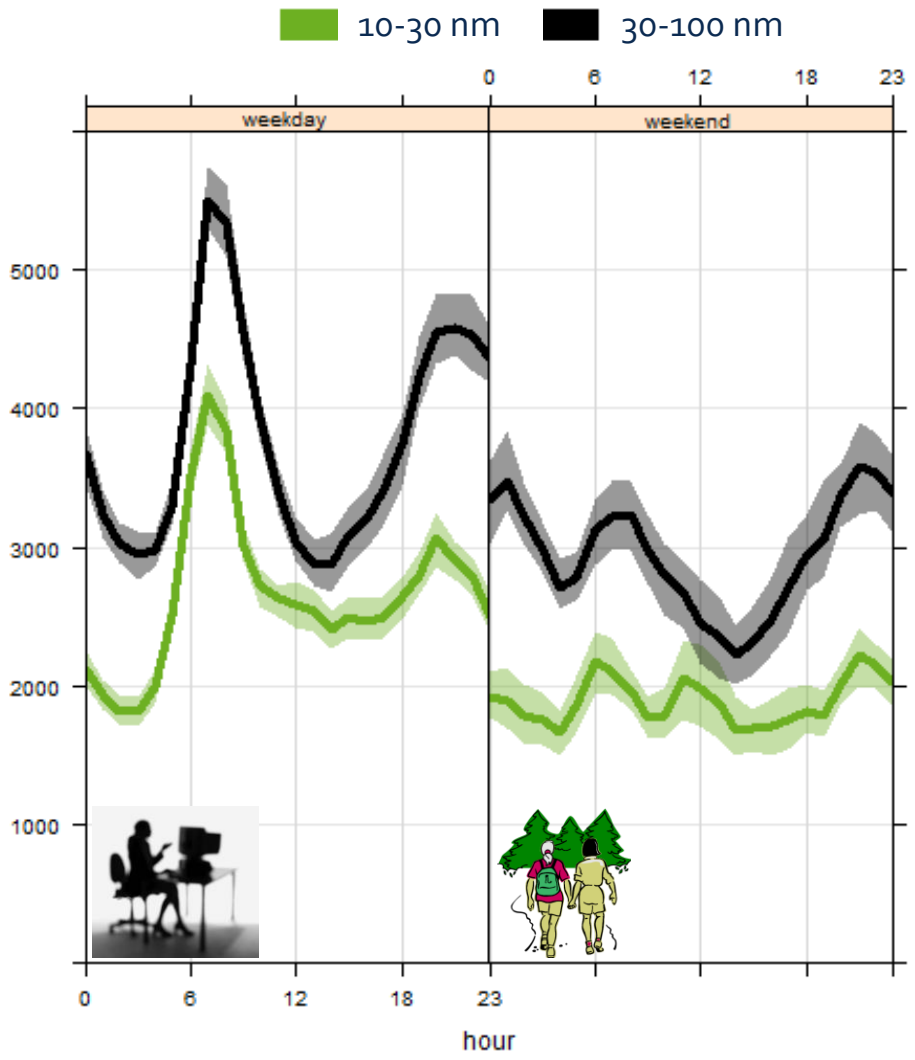
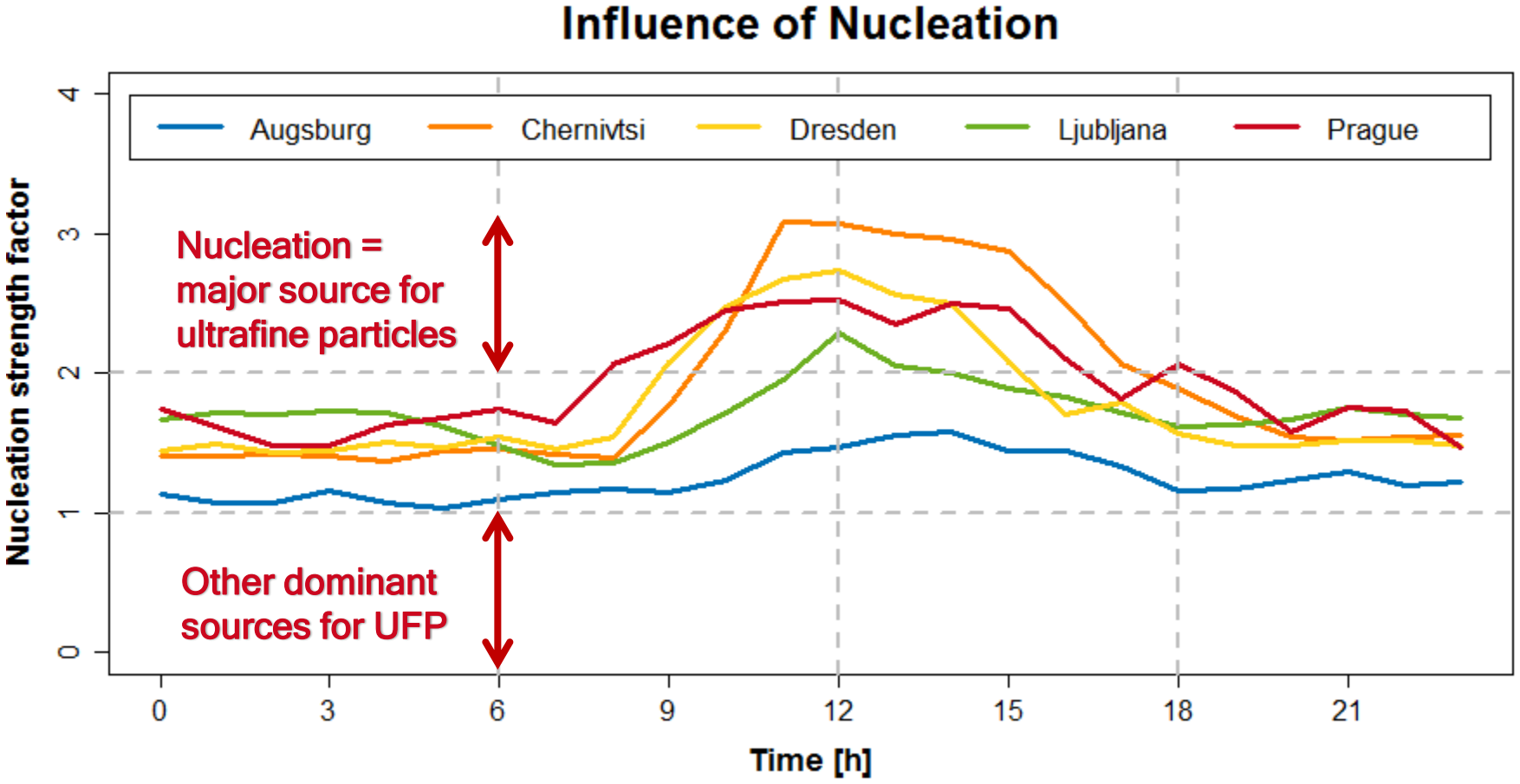
Dresden



Ljubljana

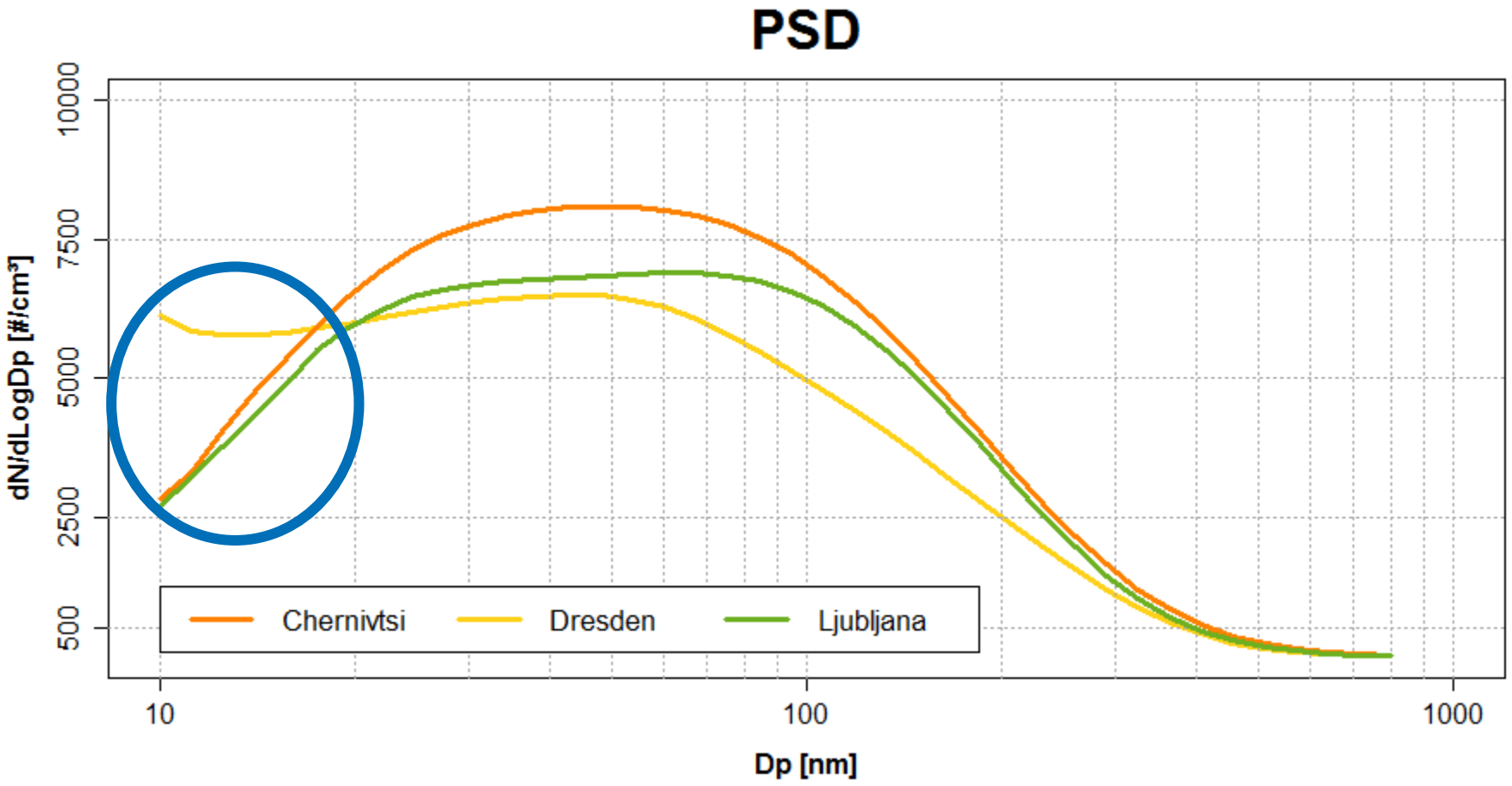


New particle formation

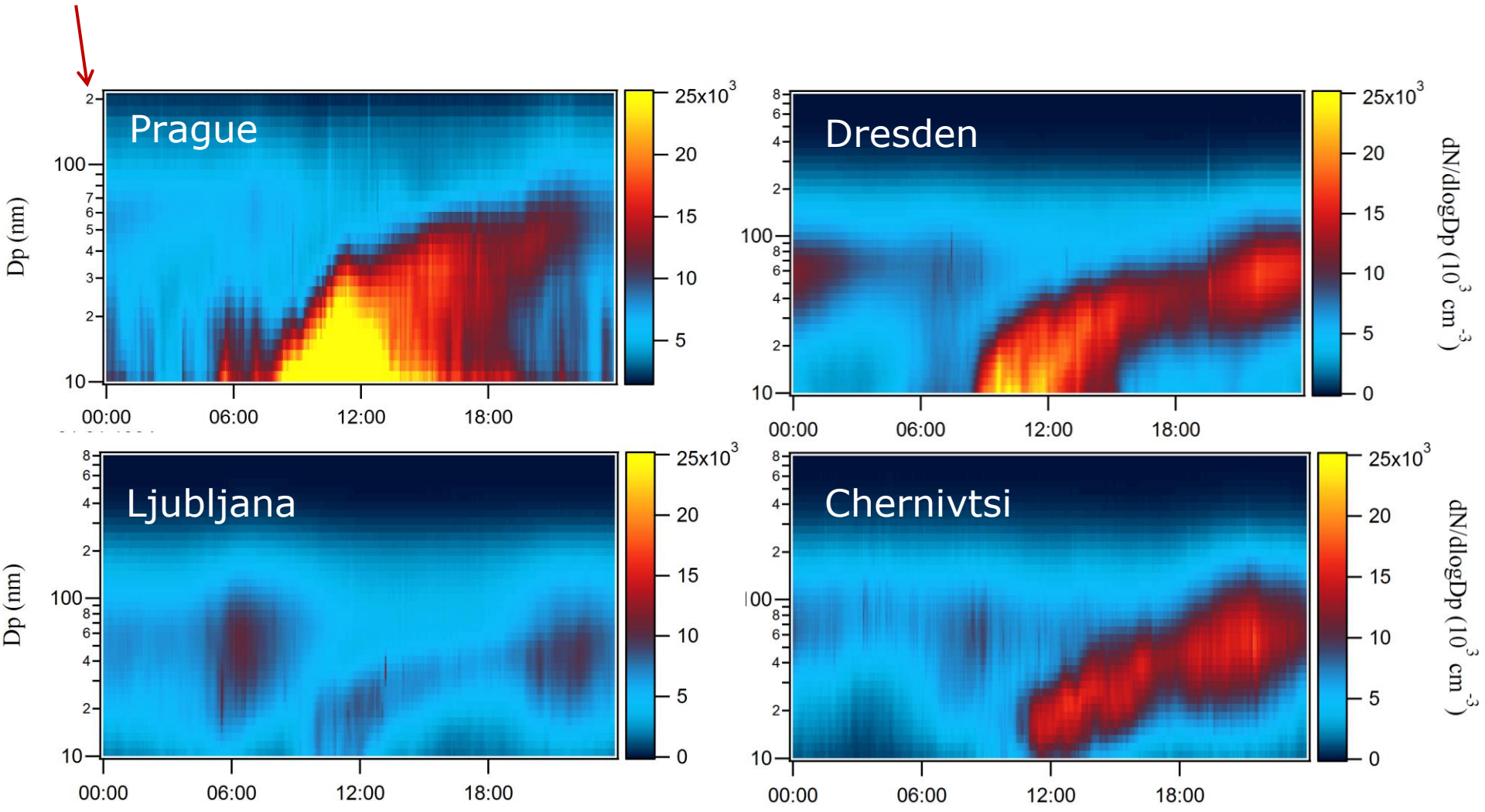


Health relevance questionable
> additional variable in UFIREG epidemiological analysis

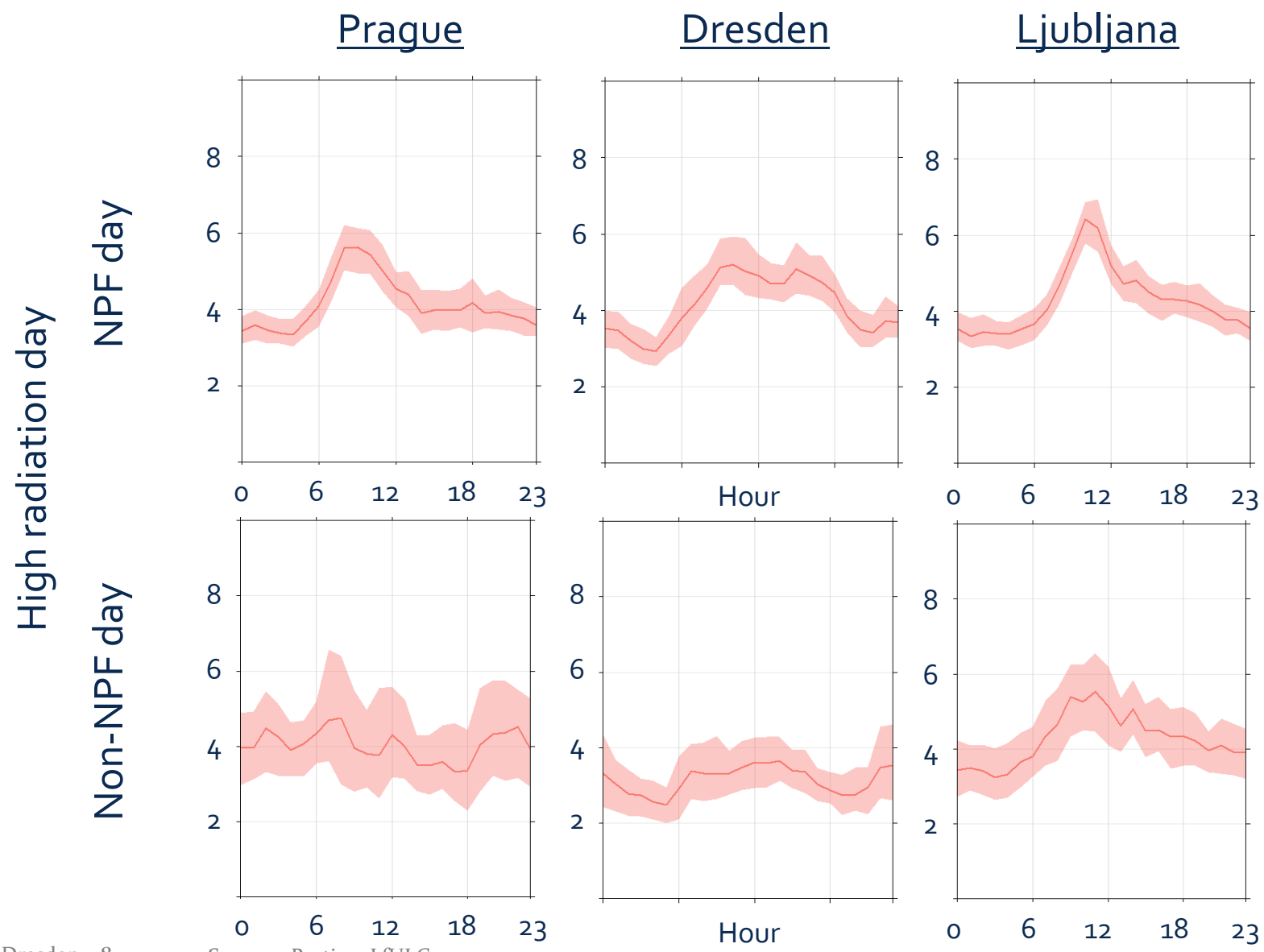
NPF impact <> UFP concentration



"Nucleation bananas"



Influence of [SO_2] on NPF



Meteorological cluster analysis

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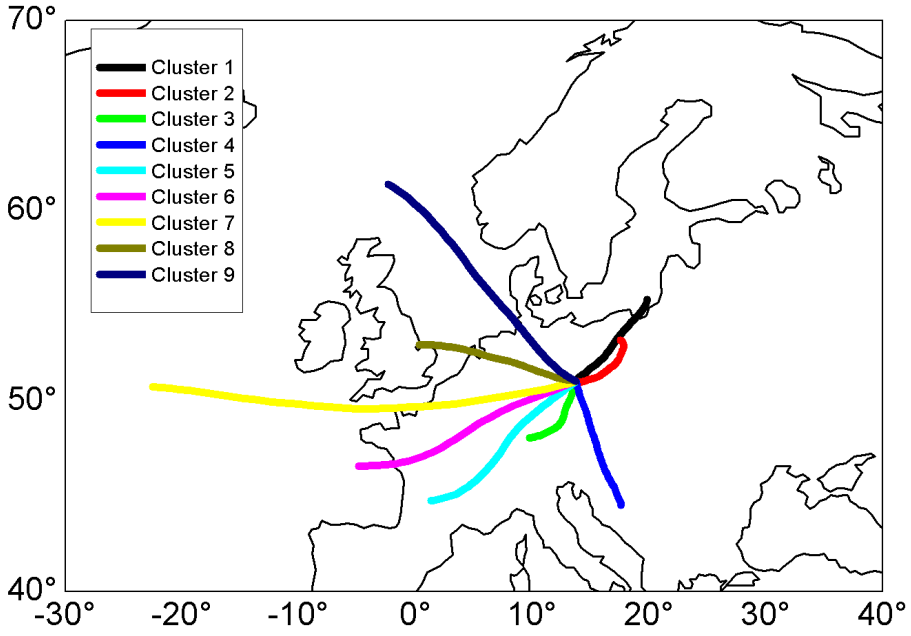
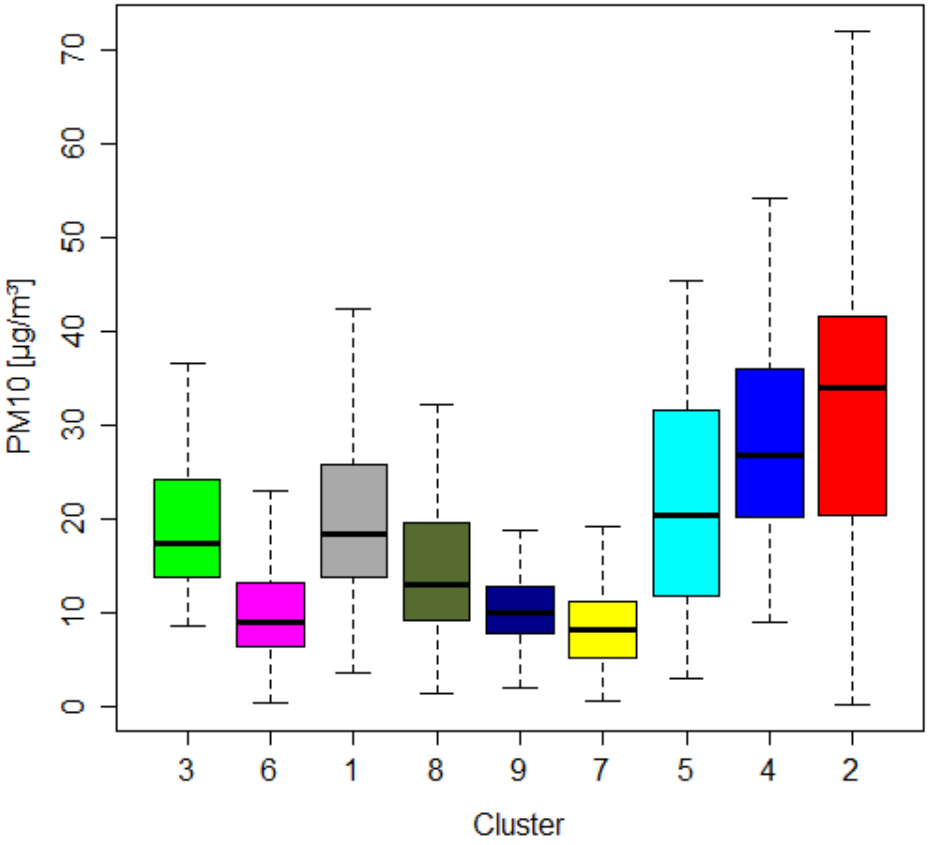
Dresden





- 48 hrs back trajectories
- 12:00 hrs UTC radio sounding
- 10:00-18:00 hrs pollutants

Meteorological cluster analysis

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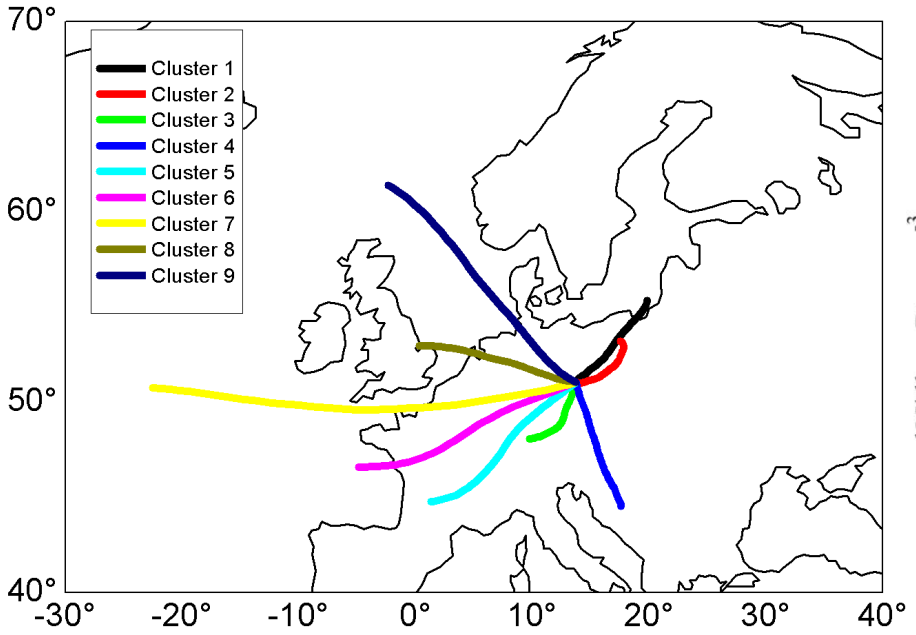

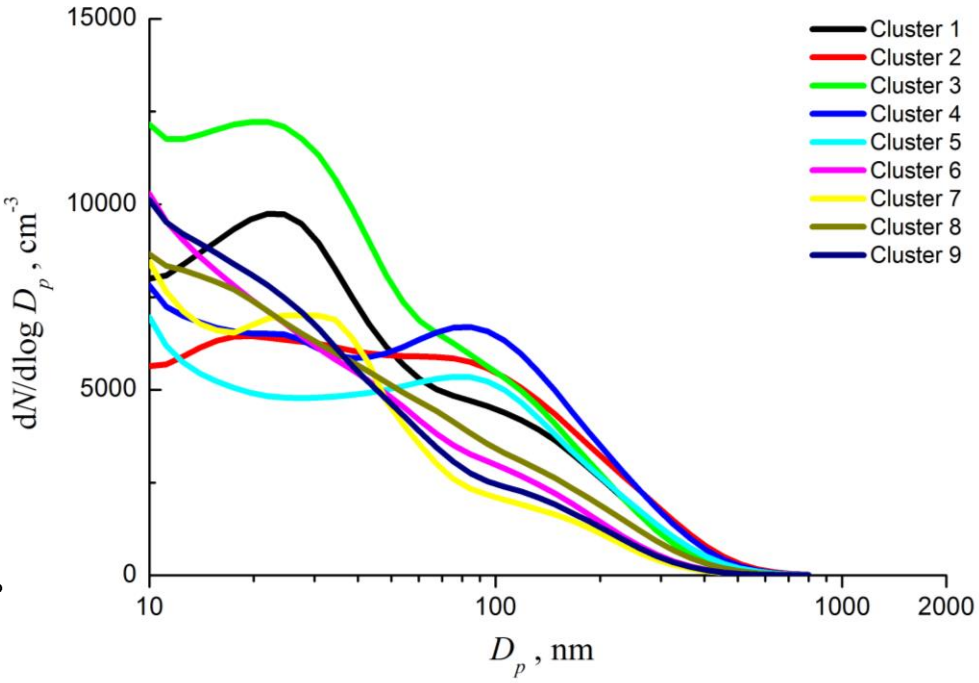

Further (on-going) analysis

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- Nucleation analysis (characterisation of NPF vs Non-NPF days)
- Correlation analysis (PNC and gases/meteorological parameters)
- Meteorological cluster analysis based on back trajectories
- Source apportionment based on PMF **(Poster from Jianwei Gu et al.)**

Conclusions

- PNC in urban areas depend strongly on
  - different sources (traffic, domestic heating, barbecue/bonfires, long-range transport, etc.)
    - ➢ Important: everyday life of people
  - meteorological conditions (air mass origin, height of mixing layer, radiation)
  - cityscape
- Extensive quality assurance is essential for comparable UFP measurements

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