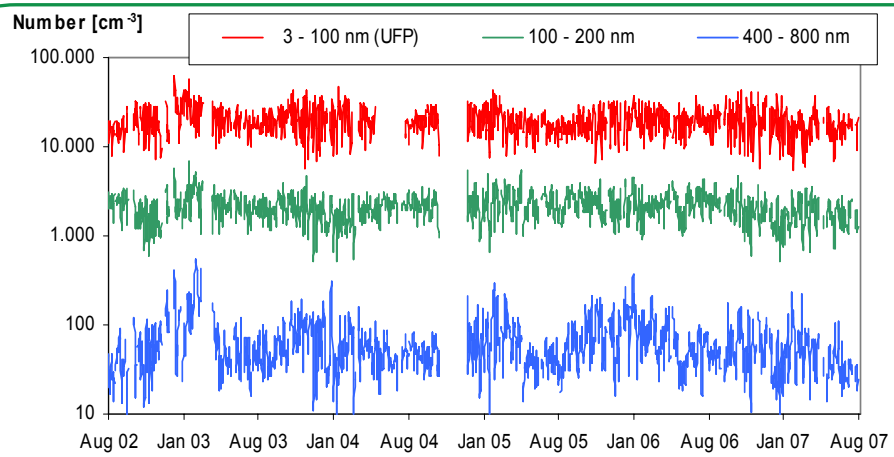
Das Lebensministerium



Five years particles number concentrations measurements in Dresden

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UFIPOLNET Conference - Ultrafine Particles in Urban Air
23-24-Oct 2007, Dresden/Germany

Freistaat Sachsen

ift

Overview

1 Introduction
- Motivation
- Instrumentation
- Measuring site

2 Results
- Average
- Trend

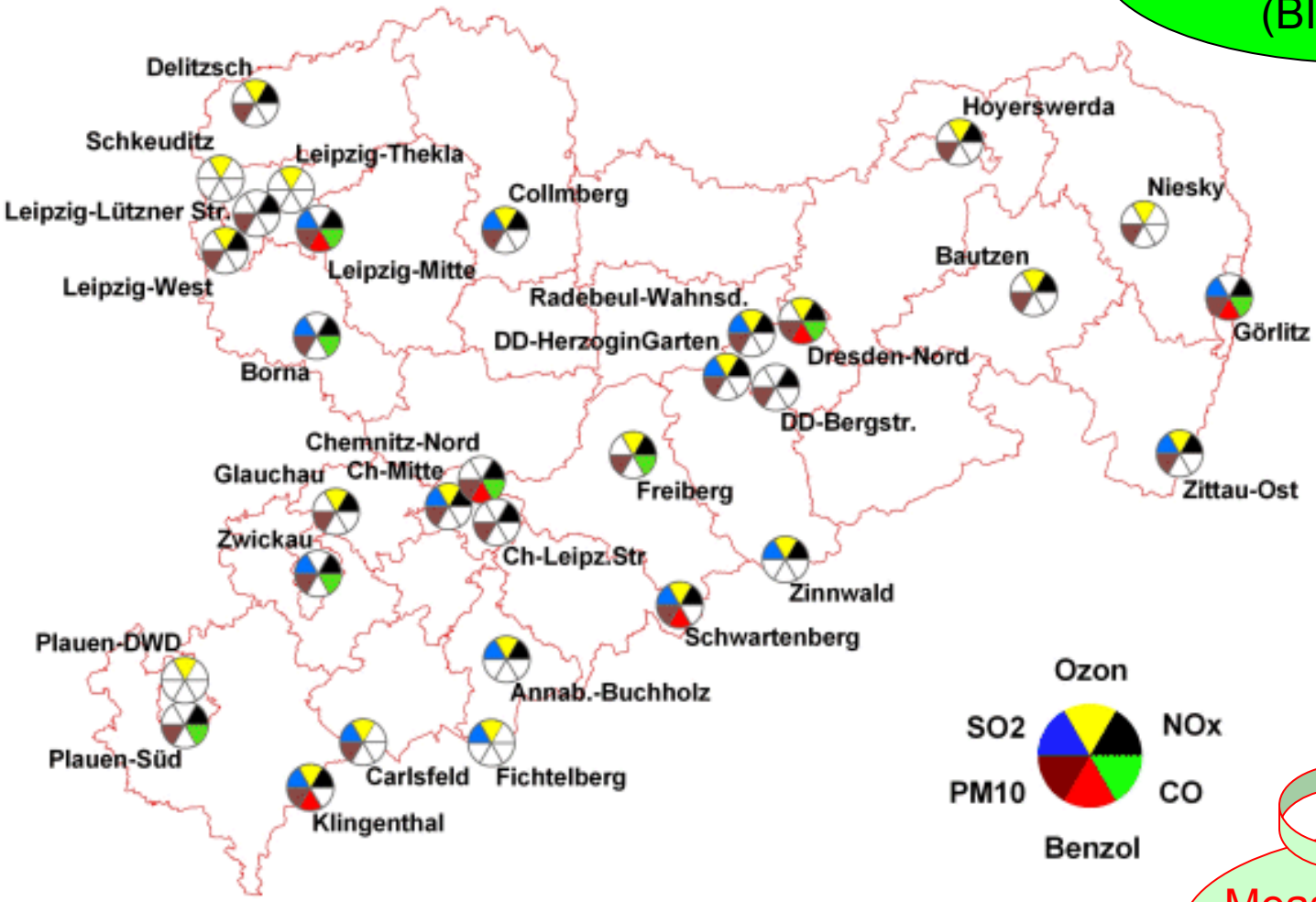
3 Some effects on particles number
- Summer/winter differences
- Reduction on Sunday

4 Summary

LfUG - Monitoring and Assessment of Regional Air Quality

Air-quality Network in Saxony (Operated by UBG)

Measurements are based on lows (BImSchG)



31 Measuring stations

locations:

- **urban streets (13 x)**
- **urban residential area (12 x)**
- **rural, hills (6 x)**

Particles:

- **25 x PM_{10}**
- **6 x $PM_{2.5}$**
- **1 x Particles number**

Measurement is based on precaution

Number of Particles in „Dresden-Nord“

Particles number concentrations and Particles size distribution

- Particle diameter from 3 to 800 nm
- TDMPS (Twin Differential Mobility Particle Sizer)
- 2 DMA und 2 Condensation counters (TSI 3010 und 3025)
- Made by IfT Leipzig

Integration into the Air-quality Network of Saxony

Reducing the measured data:

- 8 particles size classes
- ½-h-average values stored in database
- Particles size classes are verified and catalogued with all other pollutants

Teamwork:

- **UBG Radebeul** (Operation)
- **IfT Leipzig** (repairs, quality assurance)
- **LfUG Dresden** (measuring concept, data interpretation)

Measuring Station „Dresden-Nord“ (Schlesischer Platz)

Sampling point,
50 m from busy crossing
~ 50.000 vehicles/d,
~ 5 % heavy traffic

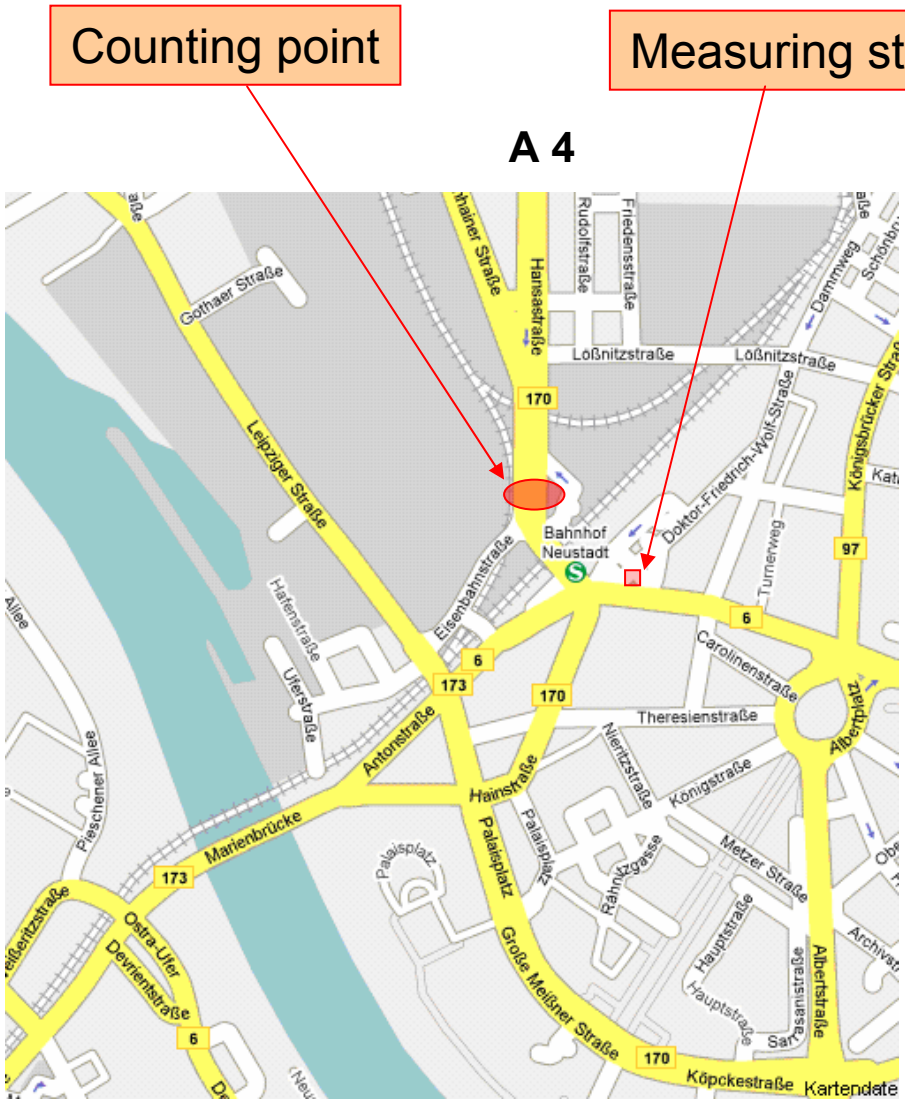
Measuring Station „Dresden-Nord“

Measuring station
~ 5 m from a road
with little traffic
~6.500 vehicles/d
~6 % heavy traffic

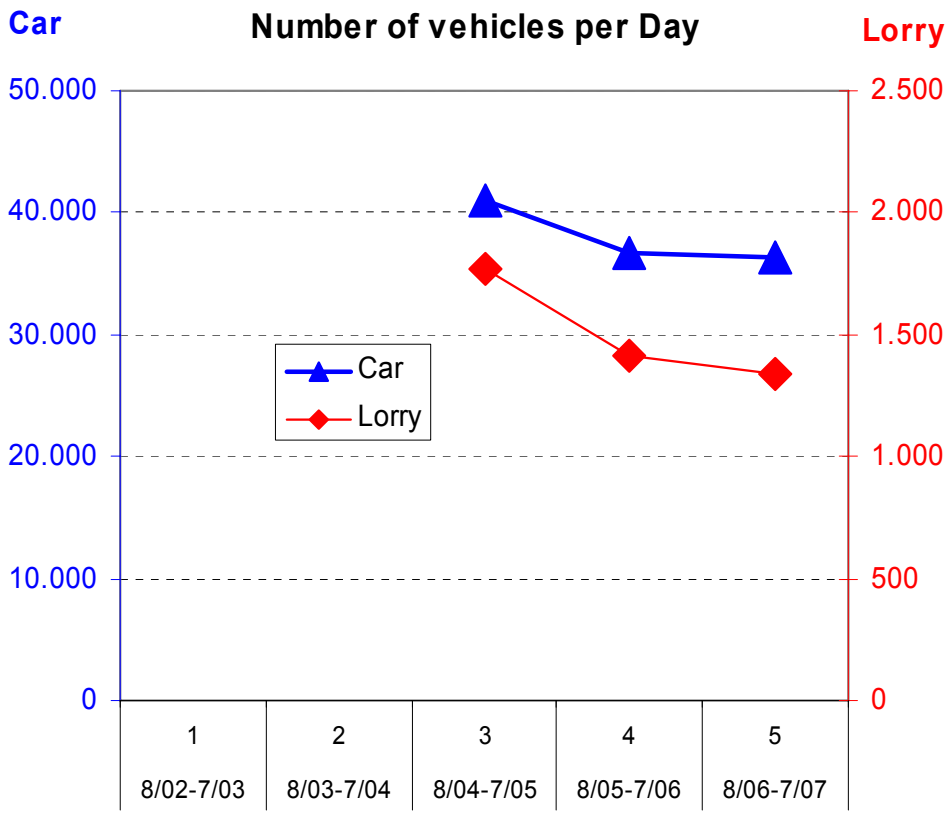
Average values over 5 years (from August 2002 to July 2007)

Gases	37 µg/m³ NO, **46 µg/m³ NO_2**, 53 ppb NO_x 2,4 µg/m³ Benzol, 0,6 µg/m³ CO
Particle mass	33 µg/m³ PM_{10} , **44 Tage pro Jahr > 50 µg/m³ PM_{10}** 21 µg/m³ $PM_{2.5}$ (64 % PM_{10}) , Im PM_{10}: 4,4 µg/m³ Ruß, 0,9 ng/m³ BaP
Particle number	23 * 10³ P/cm³ for size class 3 - 800 nm 20 * 10³ P/cm³ for utrafine particles (3 - 100 nm)
Local meteorology	temperature 11 °C, humidity 72 % wind speed 1,7 m/s, radiation W/m²

Vehicle Counting Point (from August 2004 to July 2007)



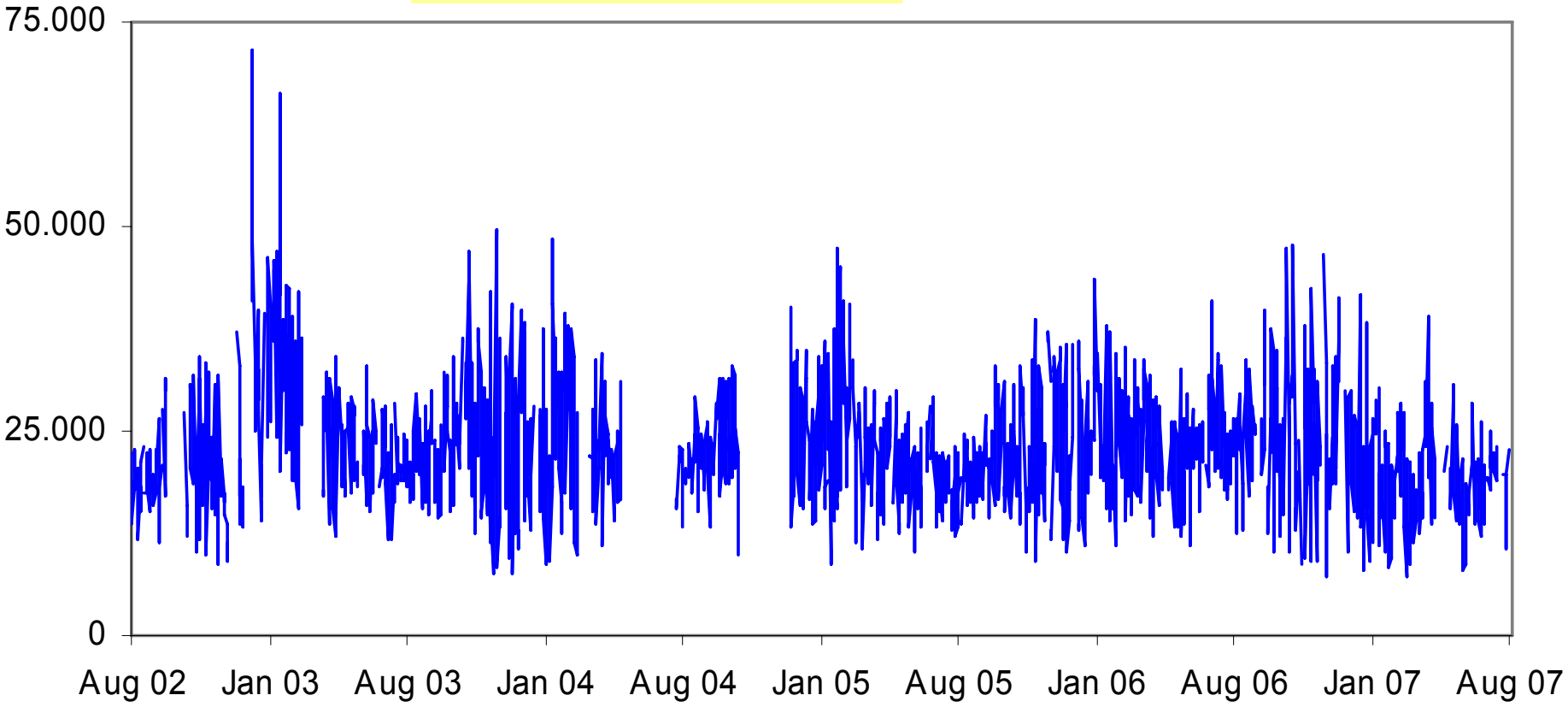
Trend:
- **Decrease in number of vehicles**
- **Increase of vehicles with diesel engine (registration)**



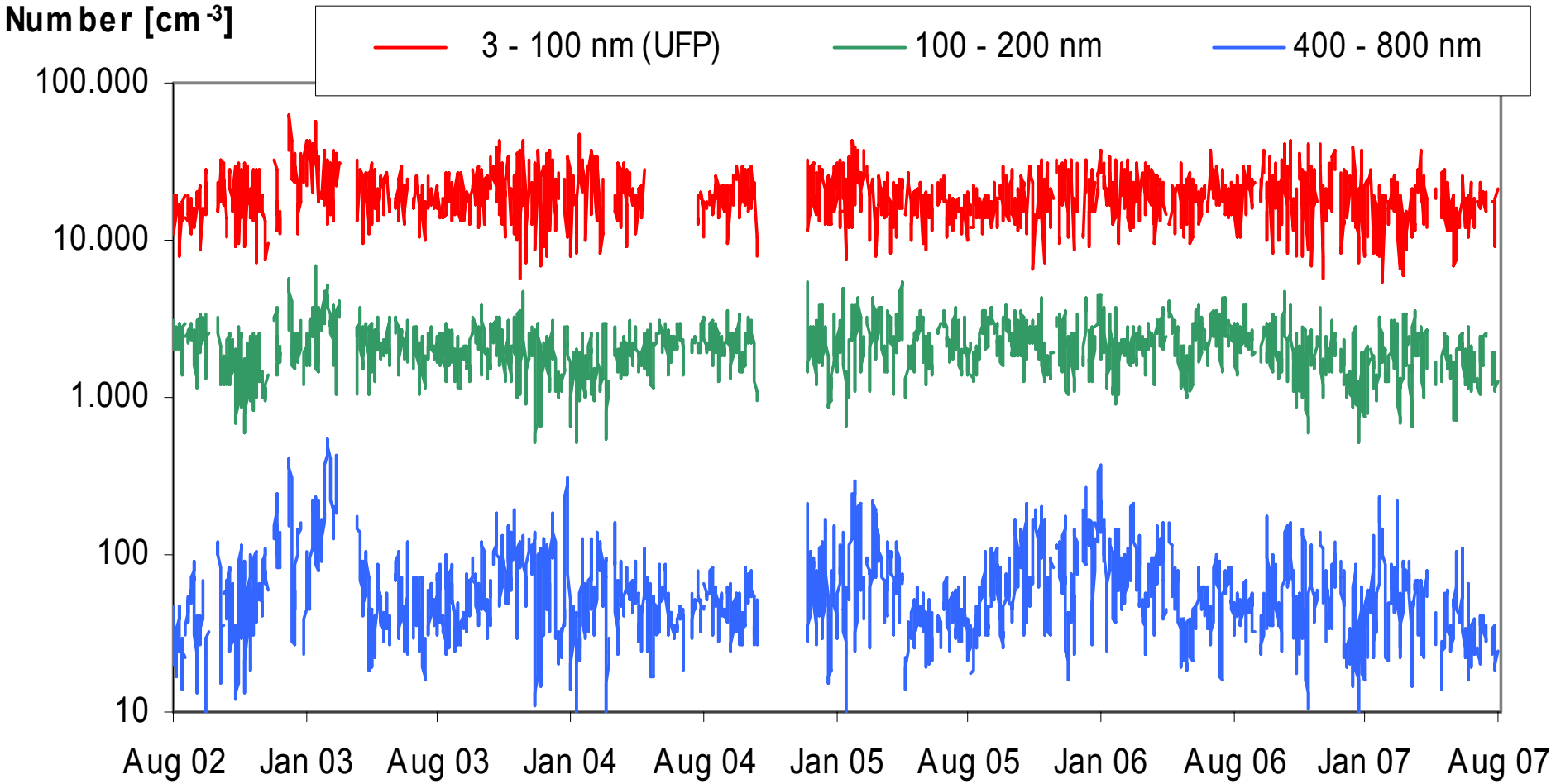
Number concentration of Particles over 5 years

Daily averages
- **Particle size 3 – 800 nm**
- **Data capture 80 %**
- **from 7.300 to 71.000 cm^{-3}**

½-h-average values
from 1.900 to 190.000 cm^{-3}



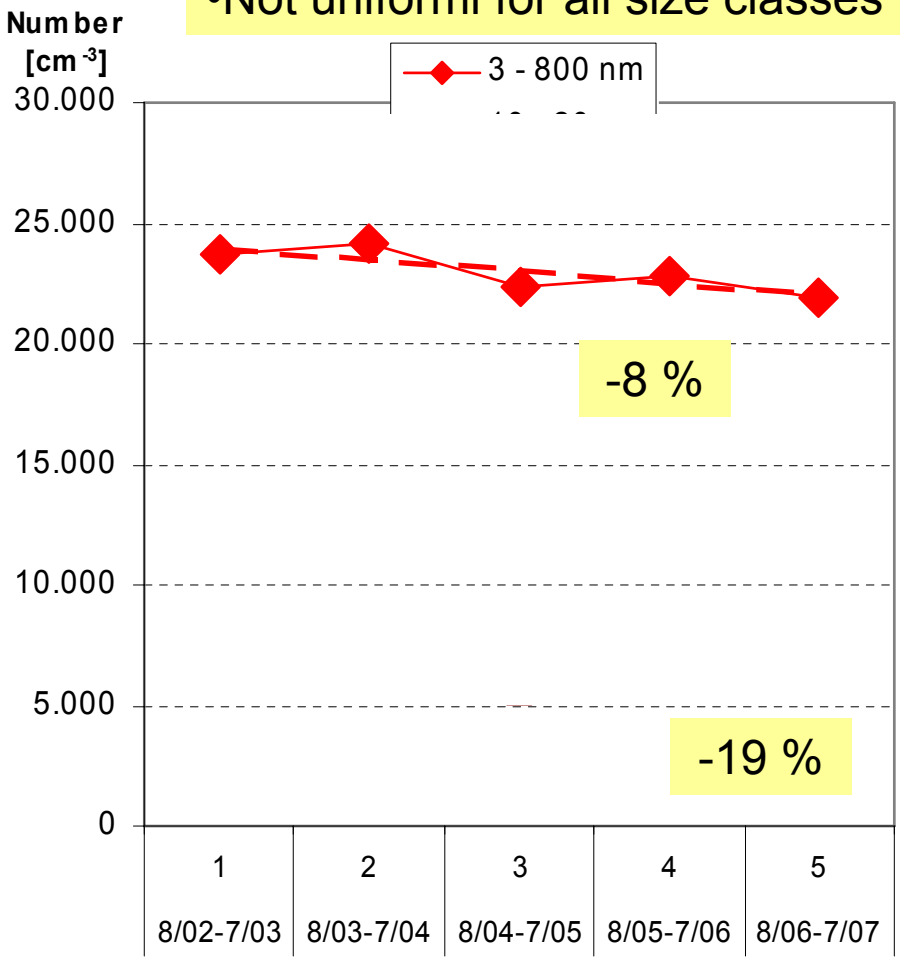
Daily Averages of 3 Particles size Classes

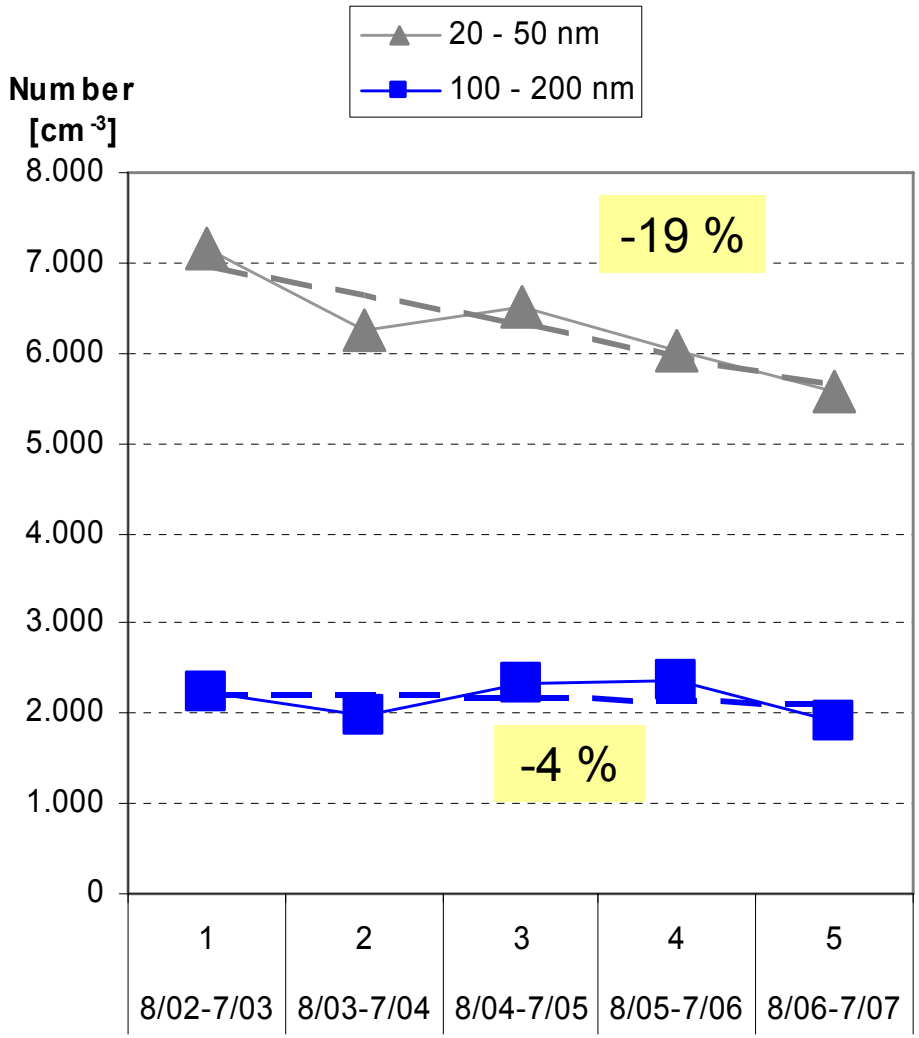


• **87 % of all particles are ultrafine particles (3 - 100 nm)**

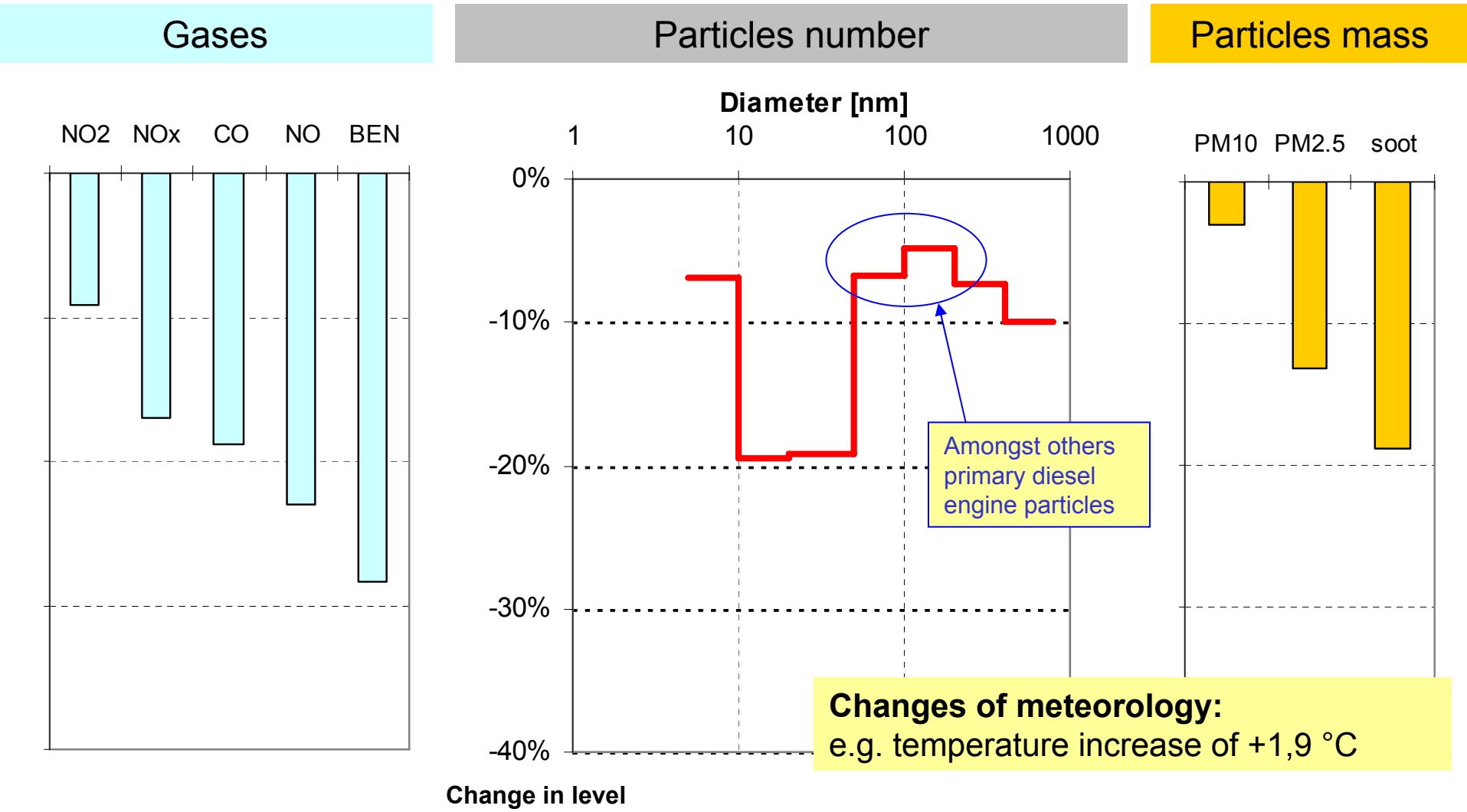
Trend over 5 years – Particles number concentrations

- Decrease in number of vehicles
- Decrease in number of particles
- Not uniforml for all size classes



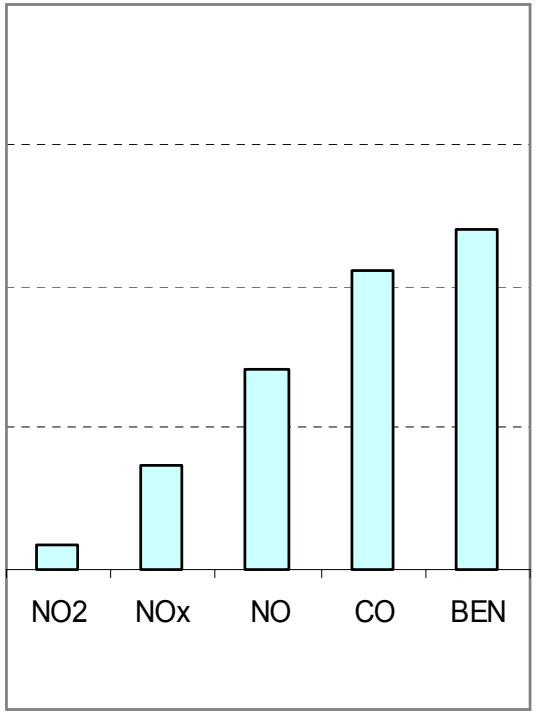


Relative Change over 5 years (Results from regression analysis)

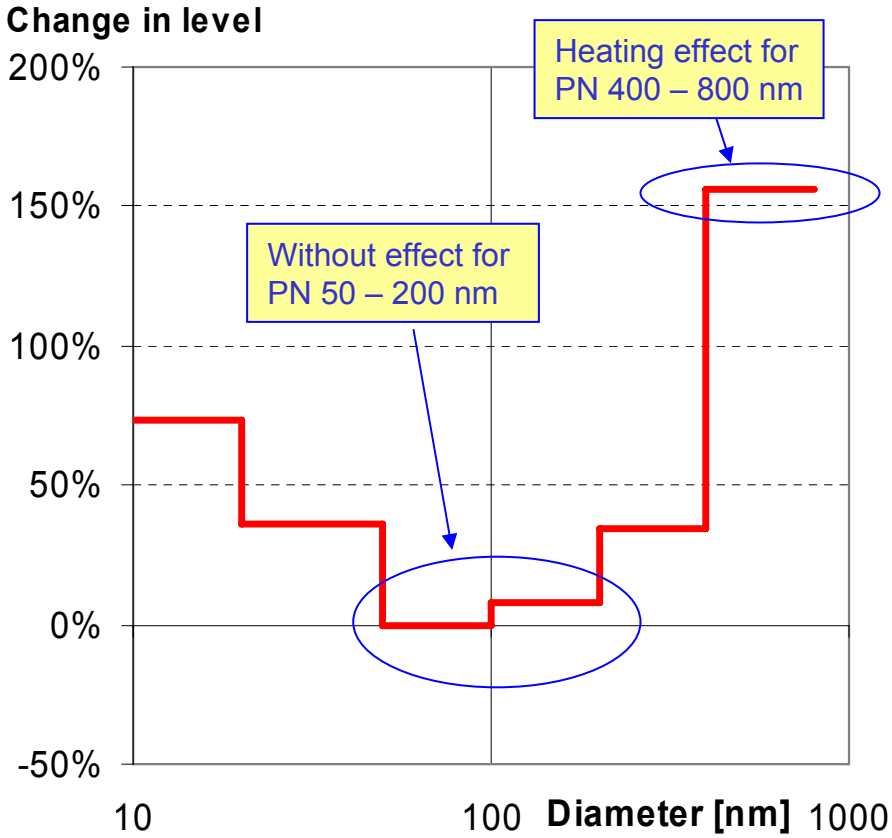


Change: warm months (t>20 °C, n=7) → cold months (t<0°C, n=9)

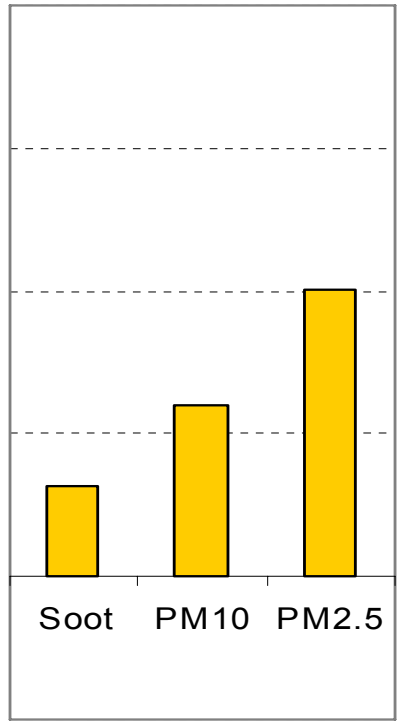
Gases



Particles number



Particles mass

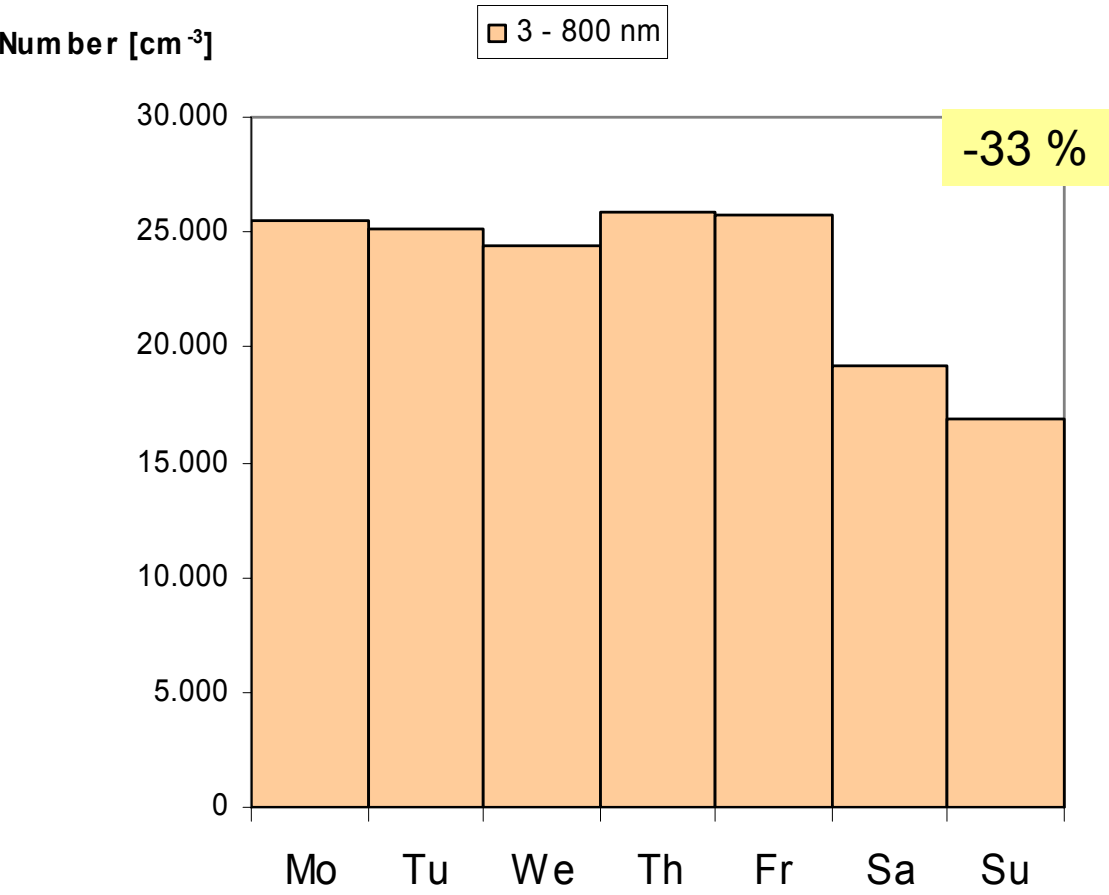


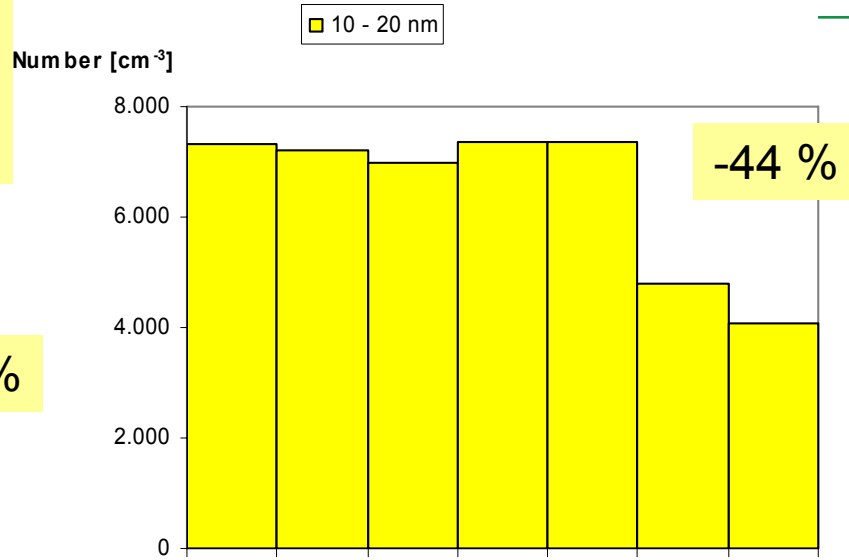
Causes

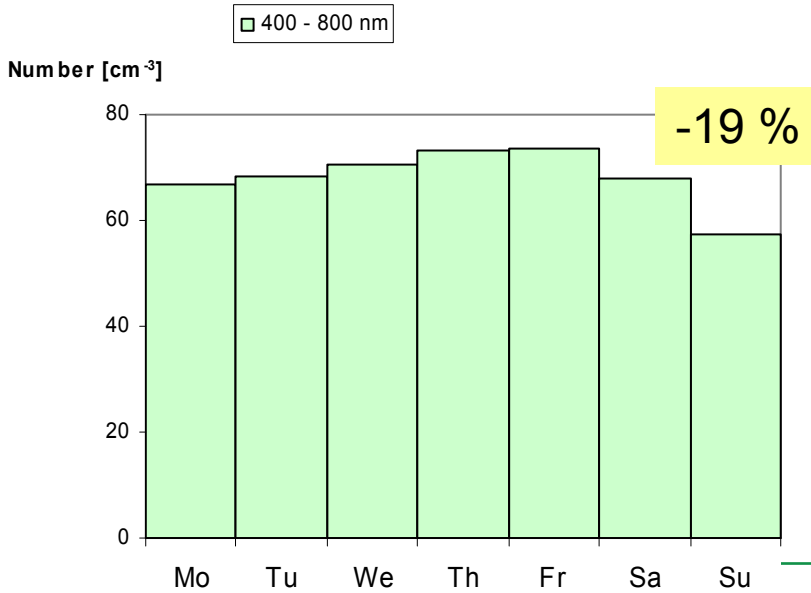
a) increased heater emissions
b) more inversions
c) increase imported particles due to high-pressured weather with wind from the east

Average weekly Course over 5 years

Reduction on Saturday due to reduction of anthropogenic emissions.
Nature doesn't know a Sunday from a Monday!

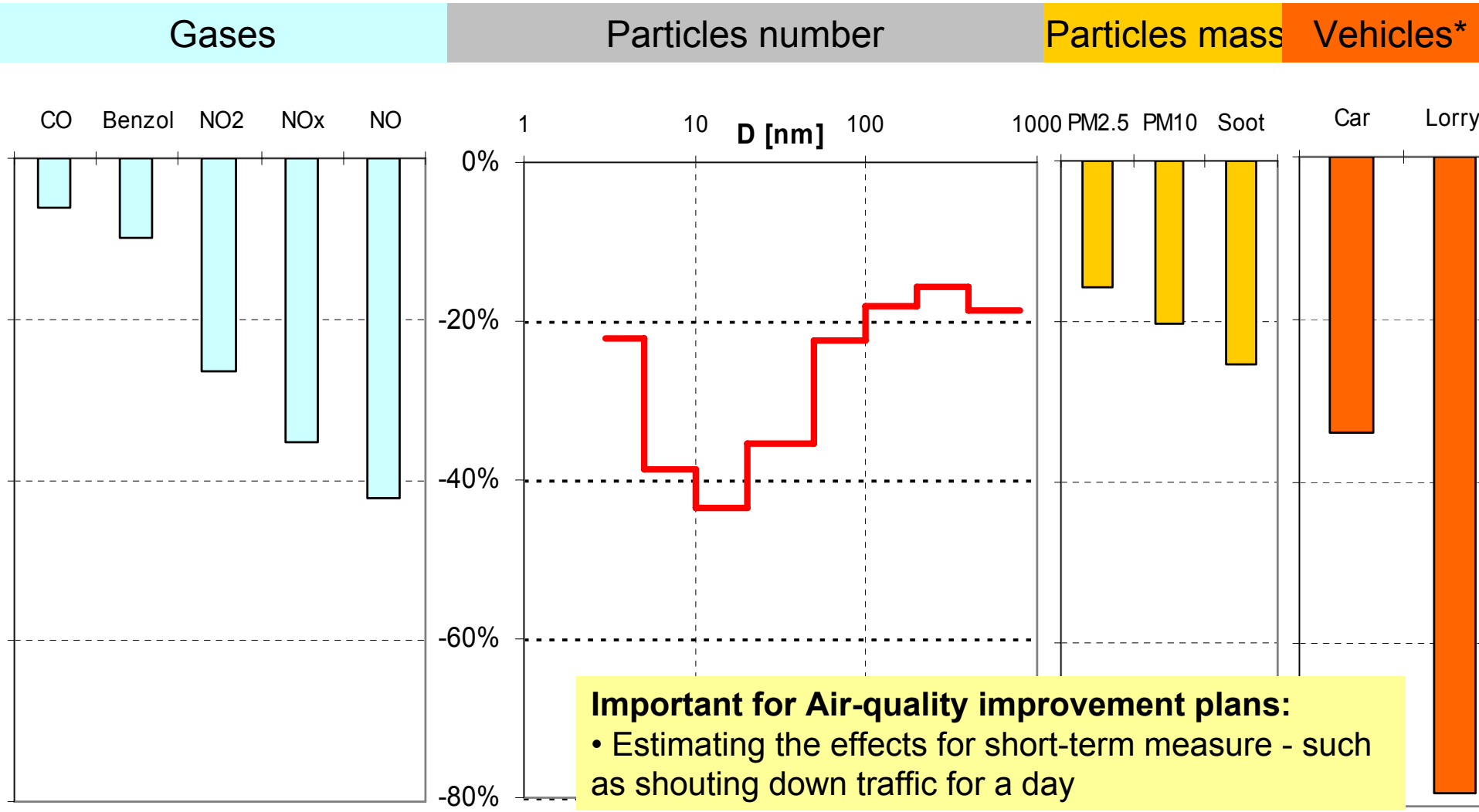






Average Reduction on Sundays over 5 years

in comparison to the average from Mondays to Fridays

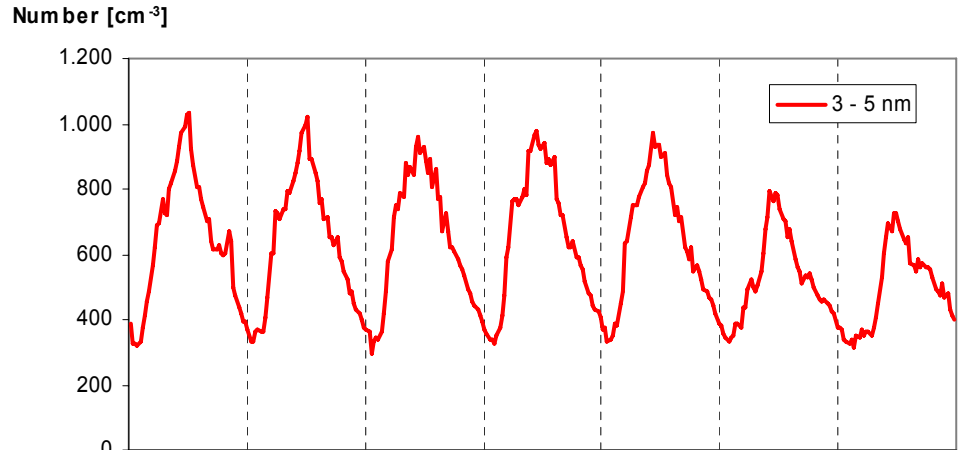


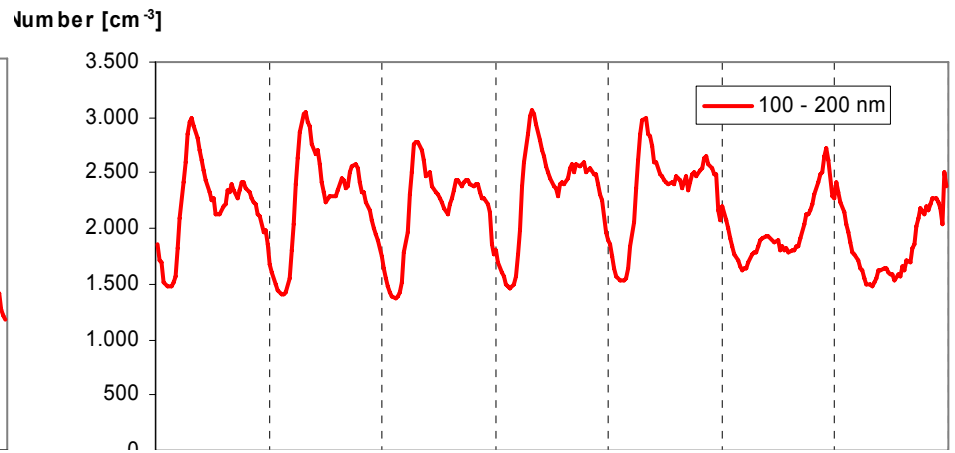
Important for Air-quality improvement plans:

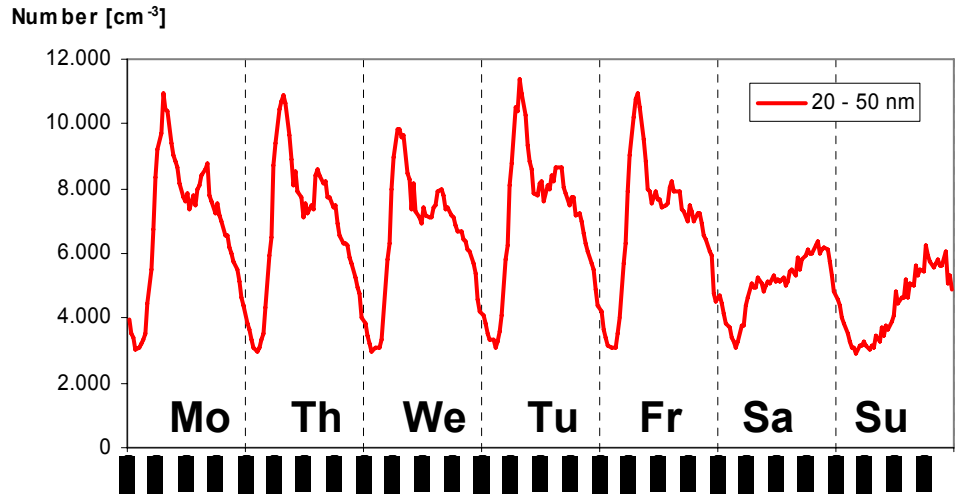
- Estimating the effects for short-term measure - such as shouting down traffic for a day

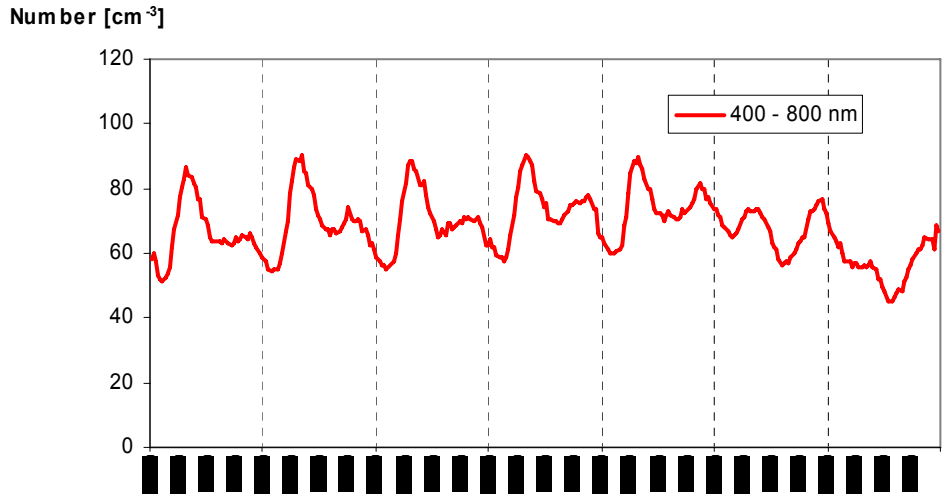
* 08/2004-07/2007

Average weekly Course over 5 years with high Time Resolution



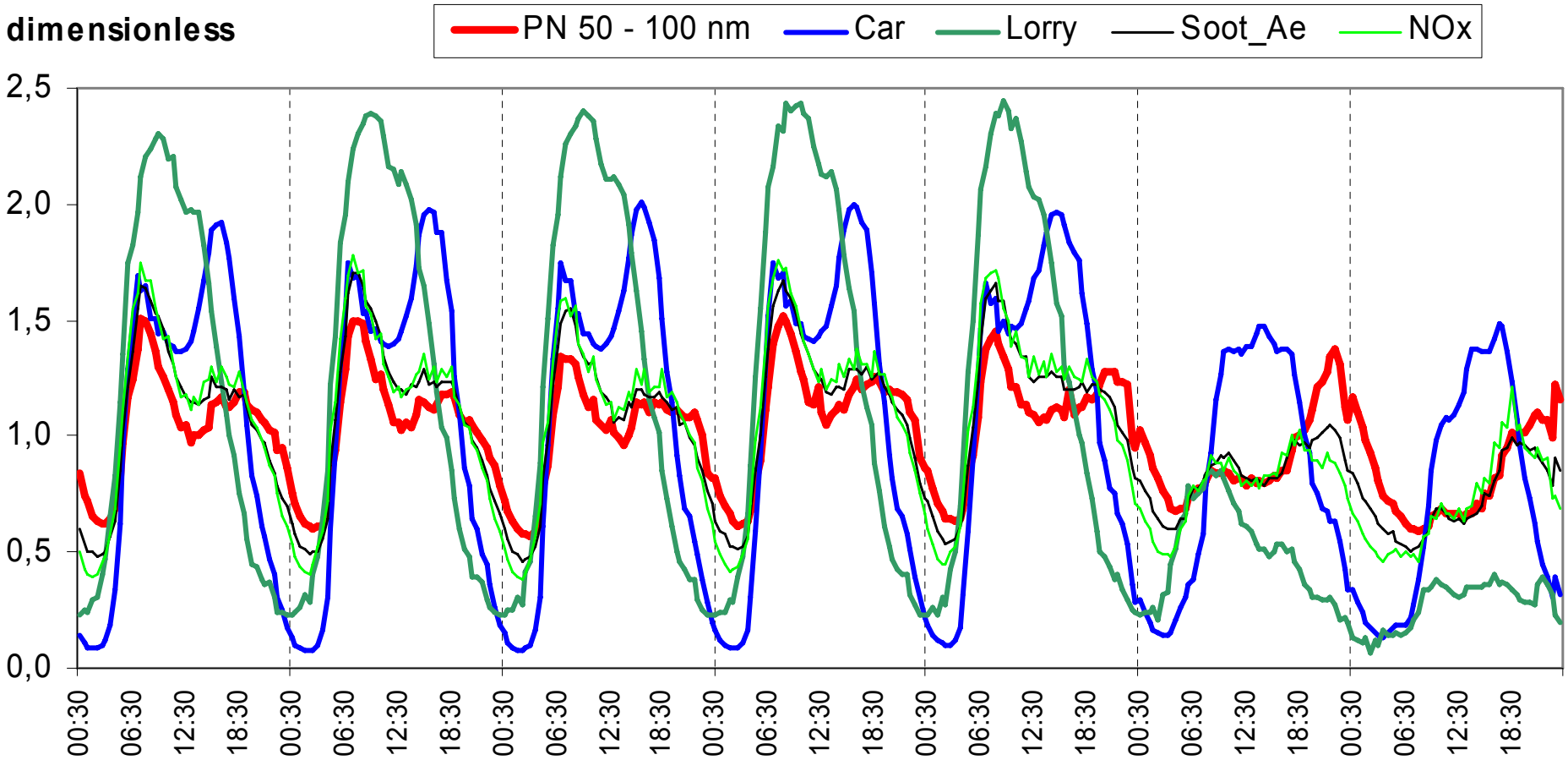






- Different shape for every size class
- The same shape for a class from Monday to Friday, but a different one for the weekend

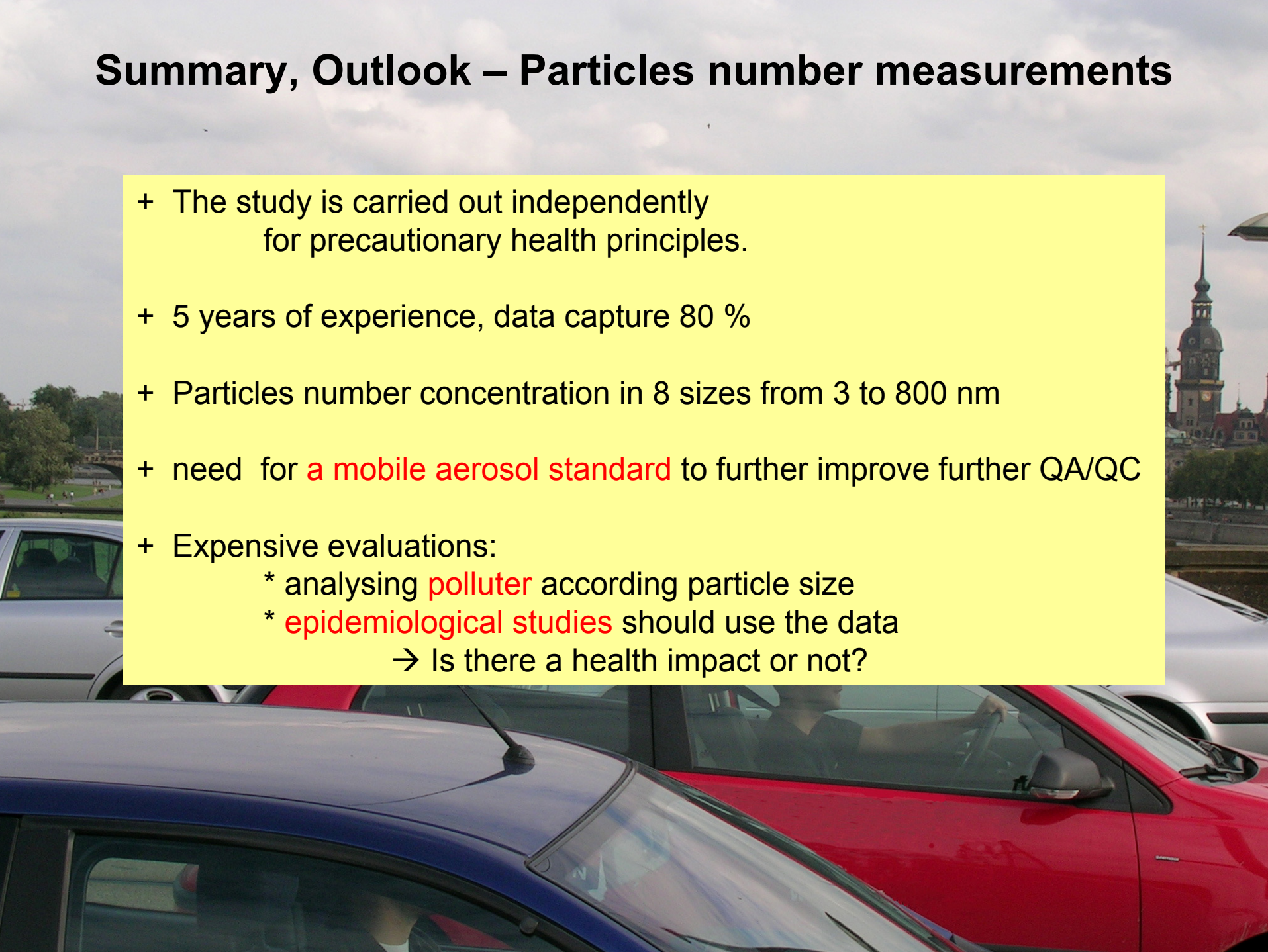
Standardized* average weekly course over 5 years



• Extensive evaluation is possible, for example analysing polluter statistics as well as air chemistry and physics

* According to average values

Summary, Outlook – Particles number measurements



+ The study is carried out independently
  for precautionary health principles.

+ 5 years of experience, data capture 80 %

+ Particles number concentration in 8 sizes from 3 to 800 nm

+ need for a mobile aerosol standard to further improve further QA/QC

+ Expensive evaluations:
  * analysing polluter according particle size
  * epidemiological studies should use the data
    → Is there a health impact or not?


Foto: Cornelia Klör

Thank you!

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