Das Lebensministerium


# Size Segregated Characterisation of Main Components in Kerbside Particulates in Dresden, Germany

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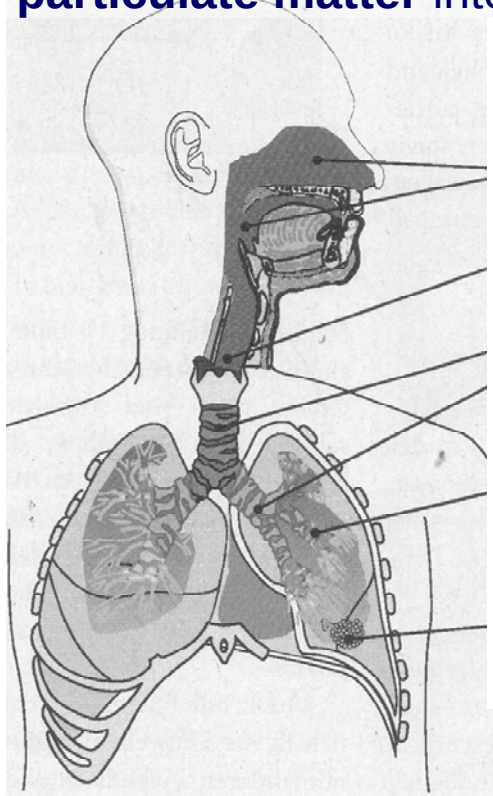
1. **Introduction: Why detecting $PM_{10}$- exceedences ?**
2. **Measurements in Dresden**
3. **Results**
   - **Characterisation of size segregated particles**
   - **3 types of size distributions**
   - **Sea salt + coarse nitrate: Long-range transport**
   - **New Year's Day**
4. **Conclusions**

- **EU-directive** for protection of health
  EU/1999/30 + in Germany: 22. BImSchV (PM10)
- **Limit value: 35 x > 50 µg/m³** PM10 daily av.
- **Dresden traffic**
  2003: 53 x > 50 µg/m³
  2005: 39 x > 50 µg/m³ (until 08-2005)
  -> air quality plan for 2005 necessary
- **Contents** of main components varies in time, place, particle diameter:
  Ammonia, sulphate, nitrate, soot, earth crust, sea salt, organic matter
- **Project:** "Korngrößendifferenzierte Feinstaubbelastung in Straßennähe in Ballungsgebieten Sachsens"

size dependent
**depth** of penetration of
**particulate matter** into human



mucous membrane of Nose
**>10 µm**

larynx
**4.7 – 6.8 µm**

trachea and bronchial tubes
**3.3 – 4.7 µm**

sec. + terminal bronchial tubes
**1.1 – 3.3 µm**

alveole
**< 1.1 µm**

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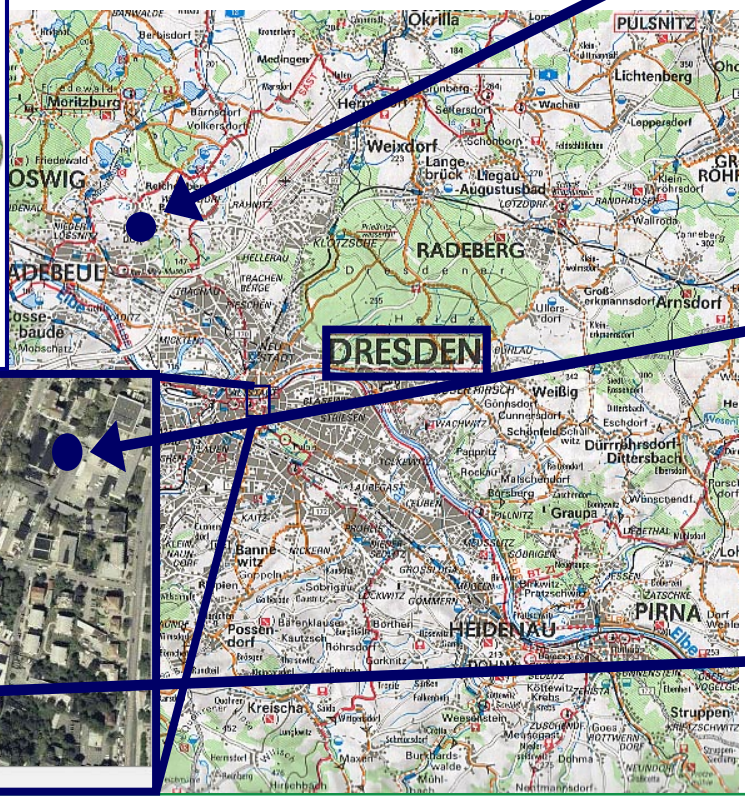
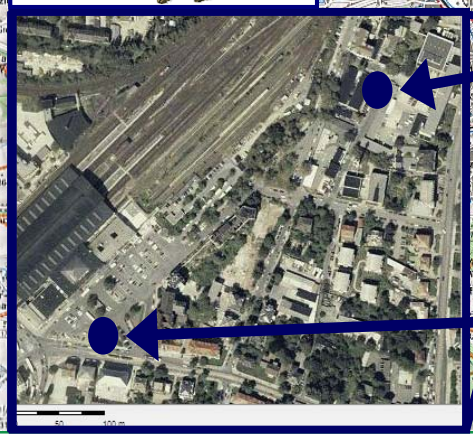
# Measurements in Dresden

## 11-08-2003 - 08-08-2004

- **Impactor**
  - 12 * BERNER 24h
  - 9 * MOUDI 96h

**outskirts (no impactor)**

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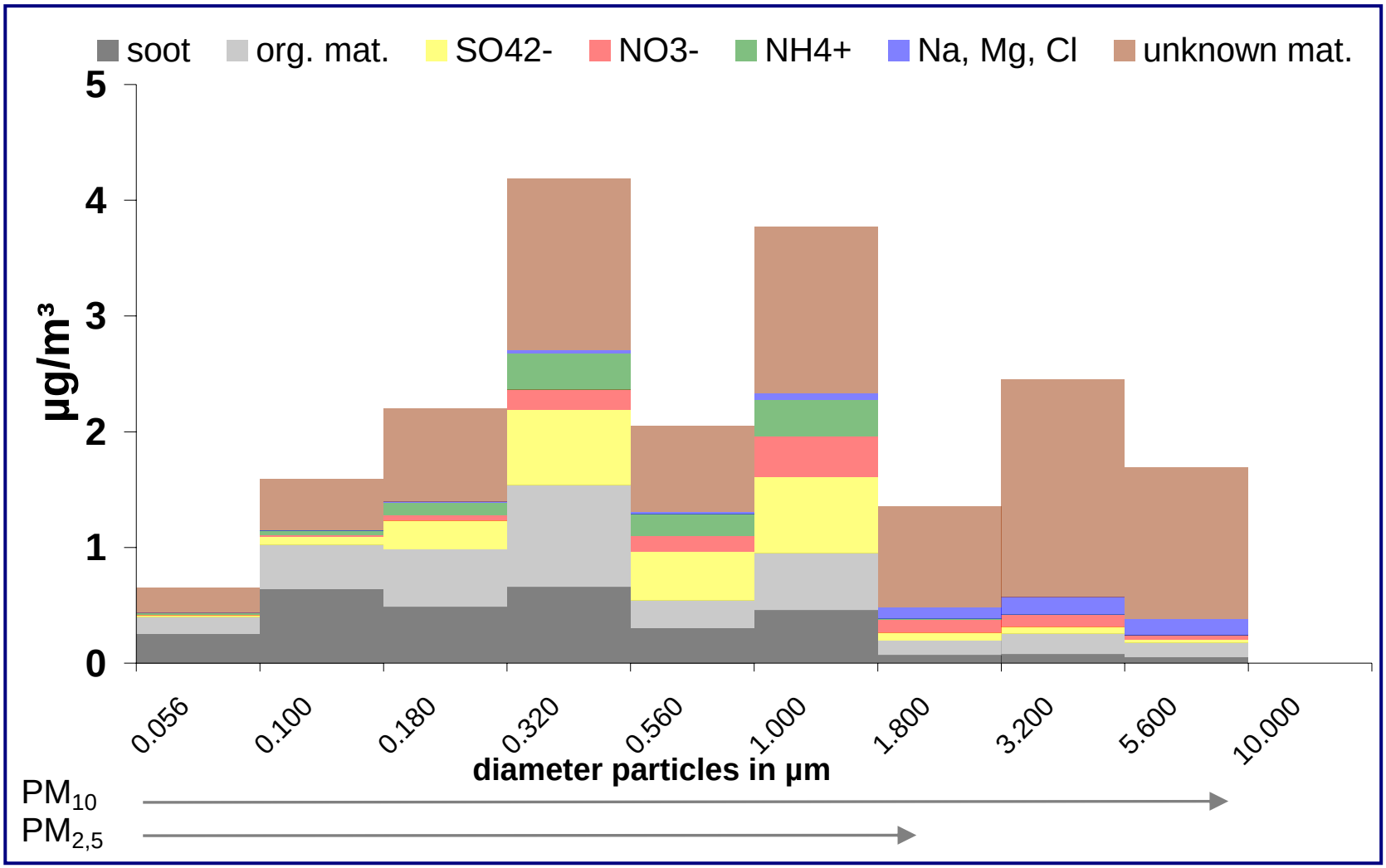
# Main components in roadside particulates (MOUDI)

average of 9 * 96 h



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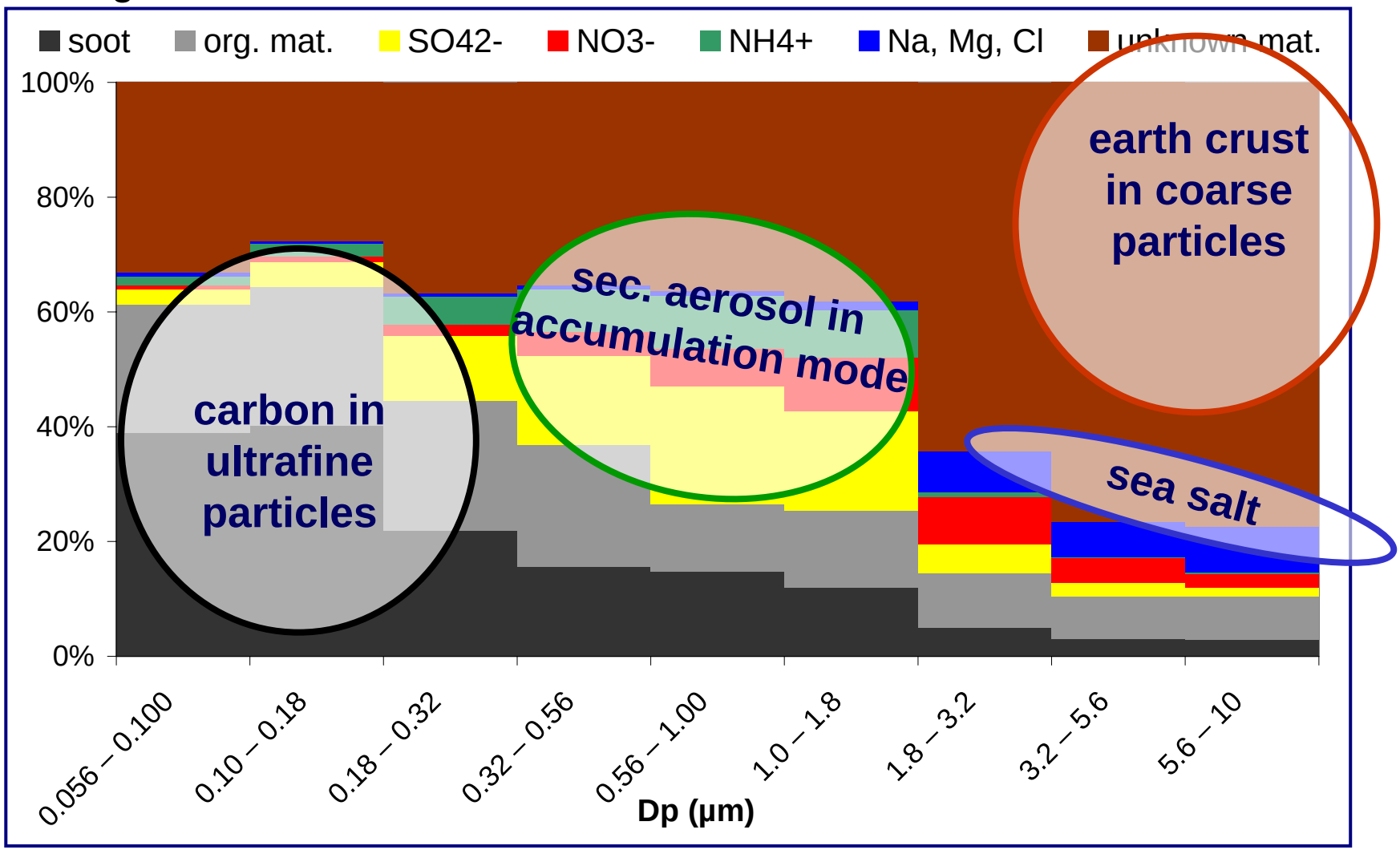
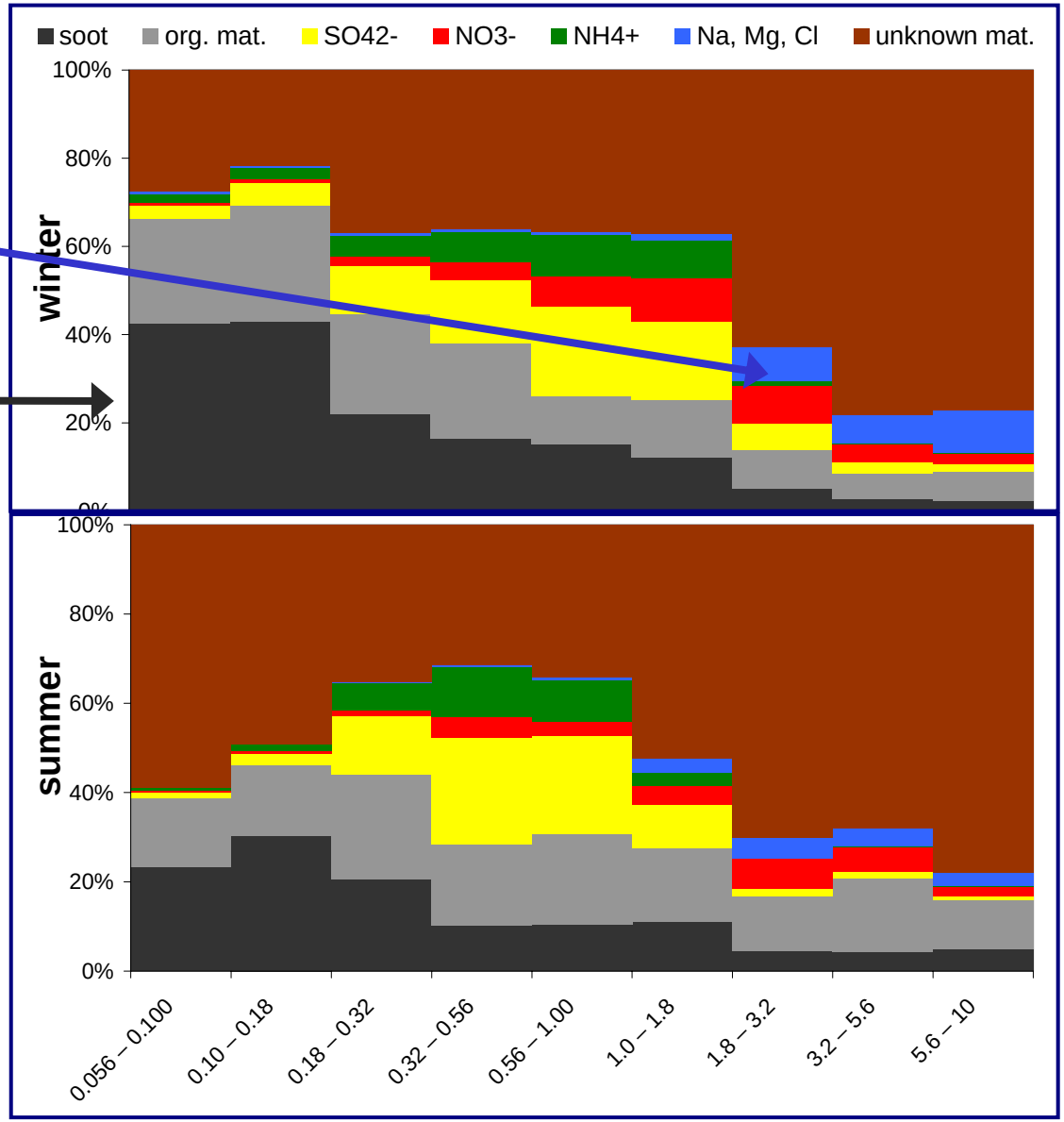


# Winter

- more Na, Cl, Mg in the coarse mode
- more soot in the ultrafine mode



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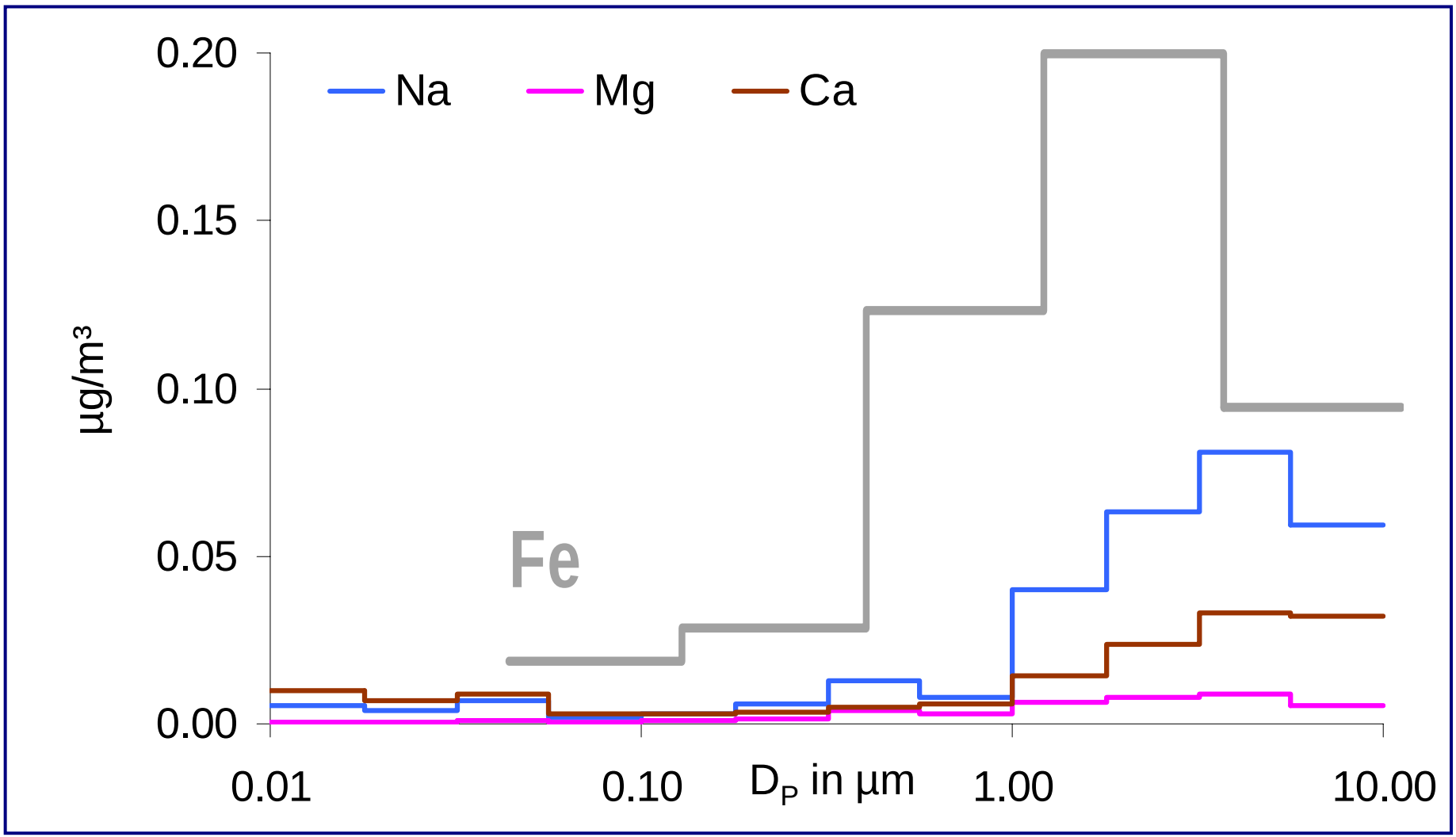
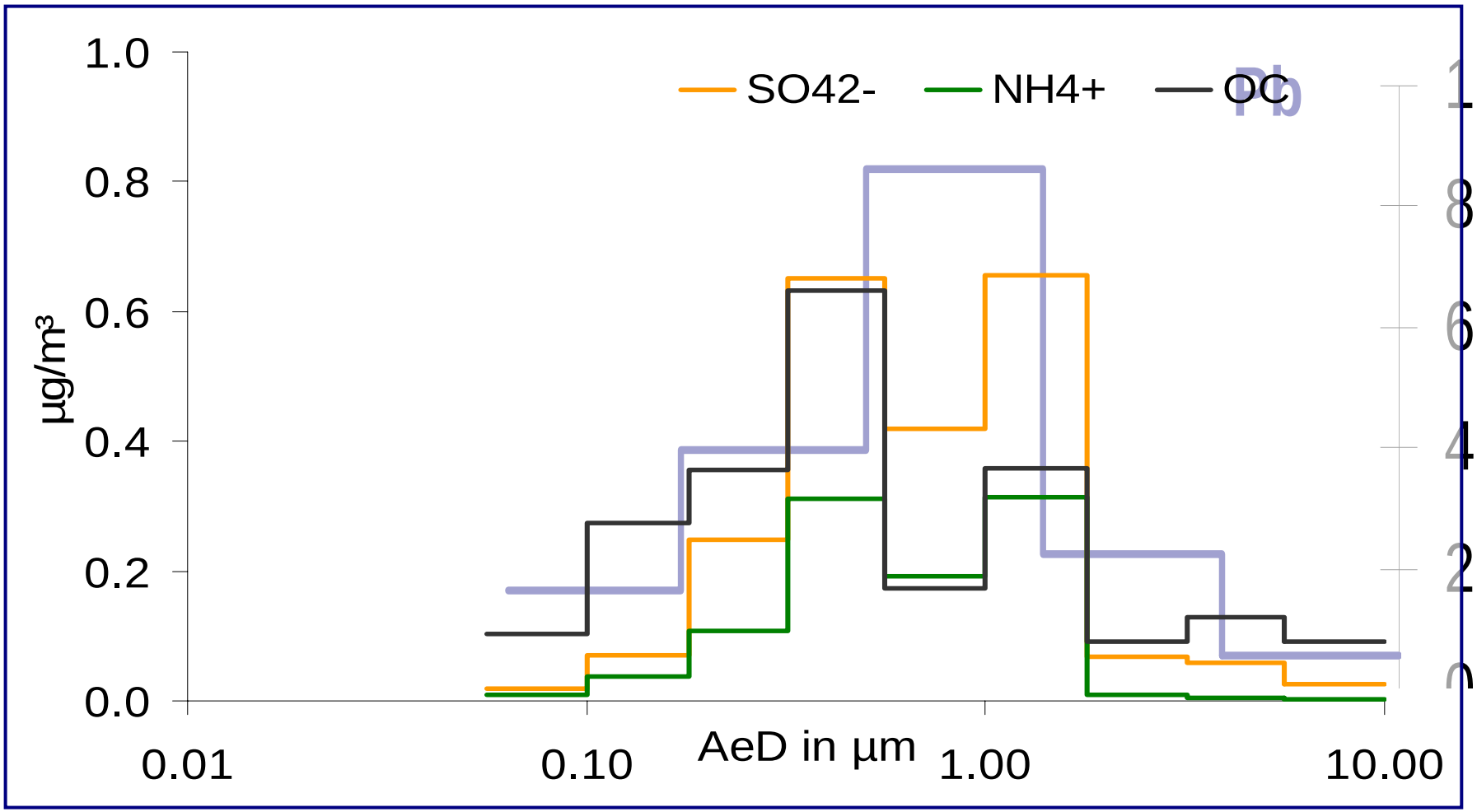
# Maximum in coarse fraction

**Na, Mg,** Cl, **Ca**, Al, Si, **Fe,** Cu

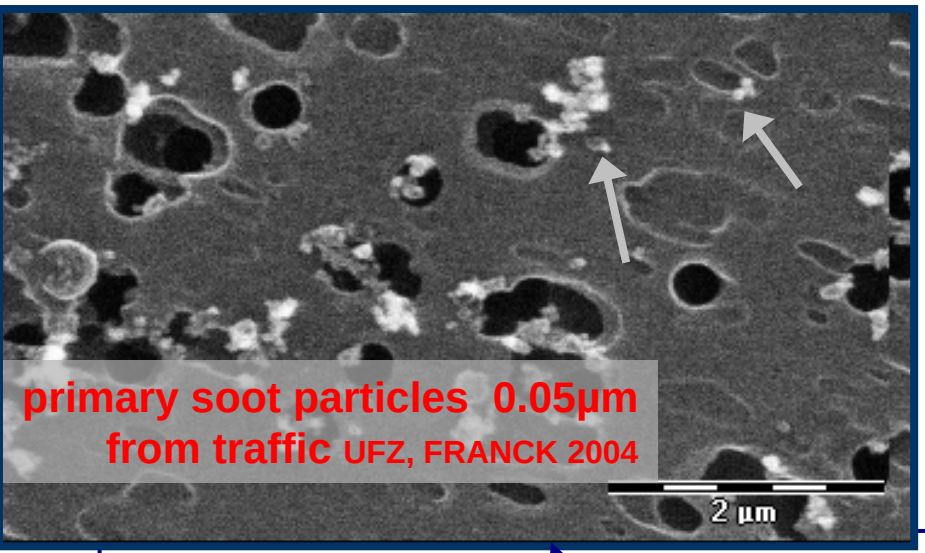


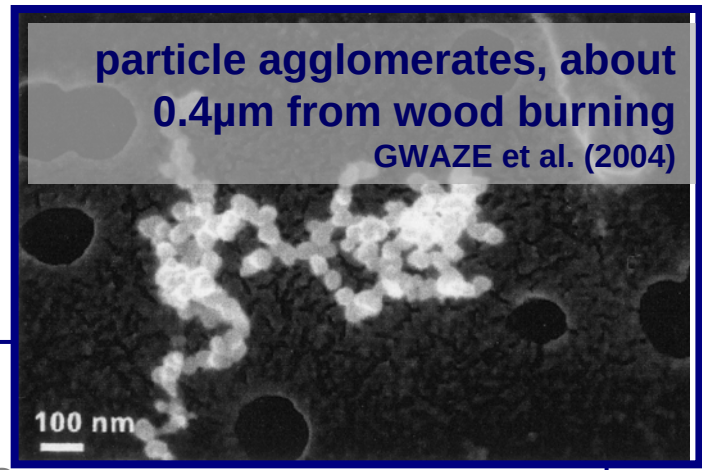
# Maximum in fine fraction

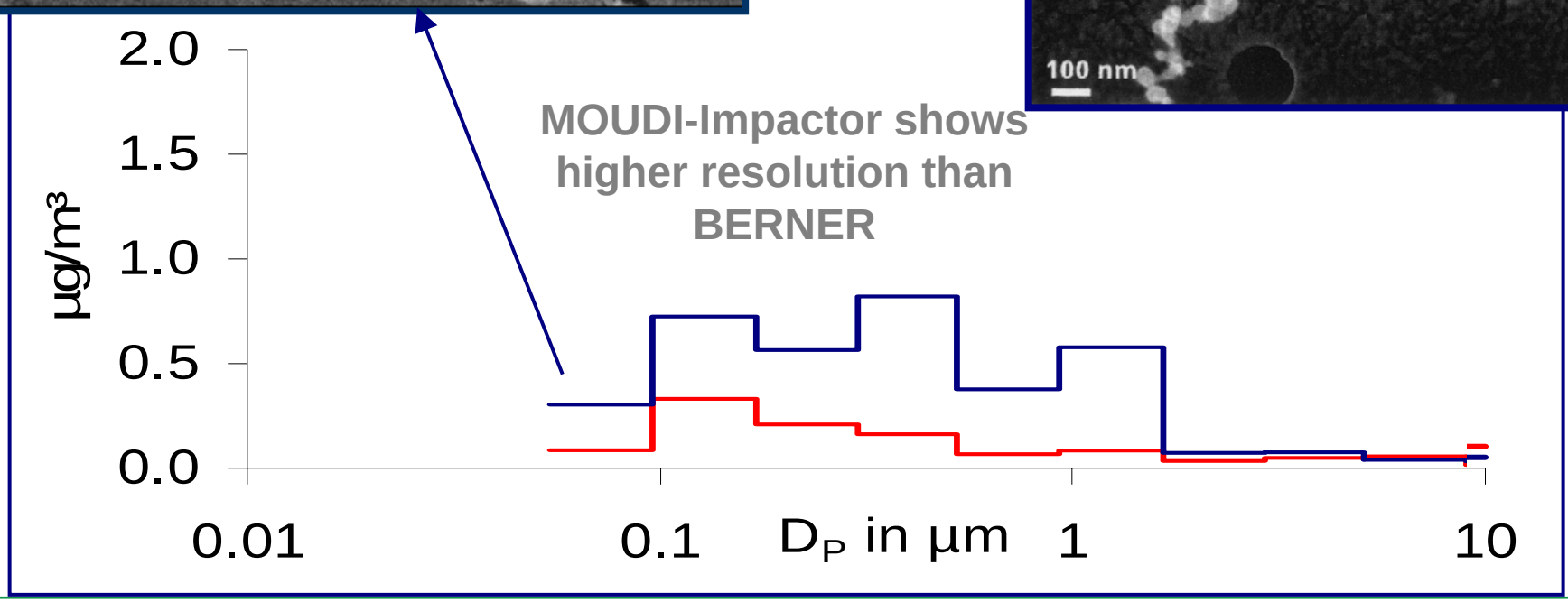
**NH4+, SO42-, soot**, **organic material**, **Pb,** Zn, K, Br, anthracen, BaP, oxygenated PAH, n-alkanes



# Soot: Summer / Winter

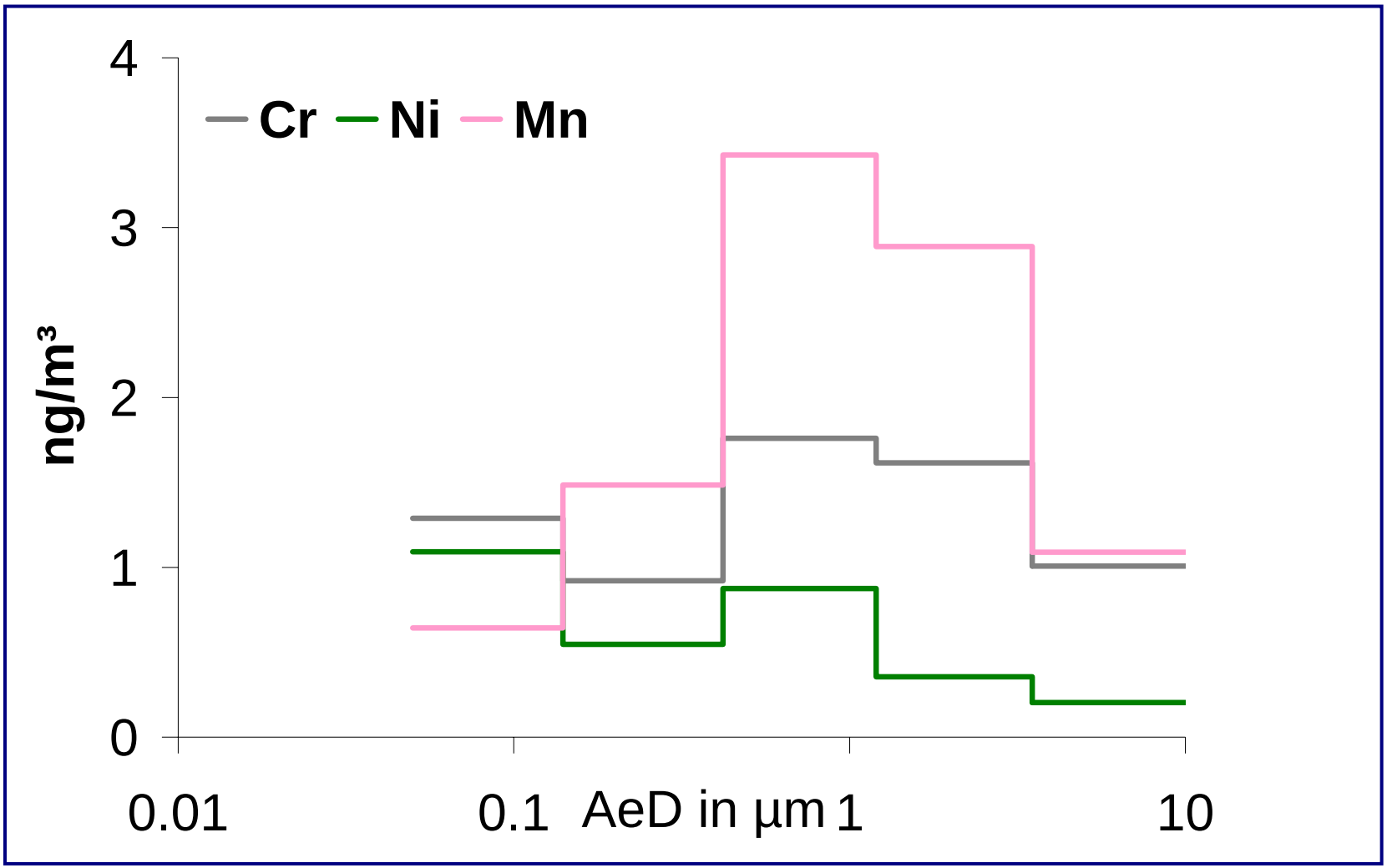


# Several maxima

## **Cr, Ni, Mn,** dicarboxylic acids



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# Sea salt:
# Long range transport

**Air masses** in Dresden coming **from North Atlantic** on **9-10-2003**

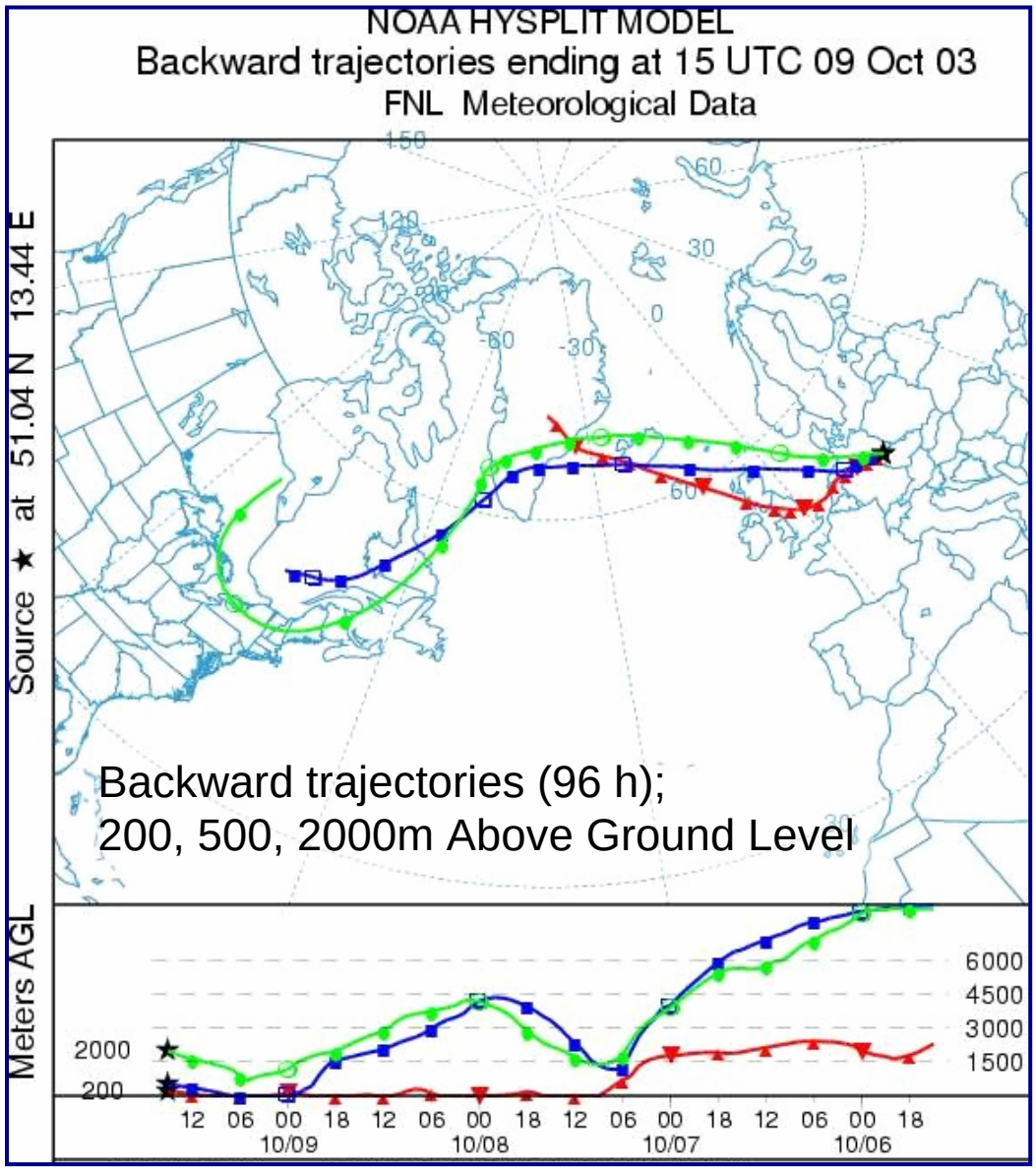
- **relation Cl/Na:**

| | | |
|---|---|---|
| sea | | = 1,164 |
| BERNER | $PM_{10}$ | = 1.175 |
| HVS | $PM_{10}$ | = 1.018 |

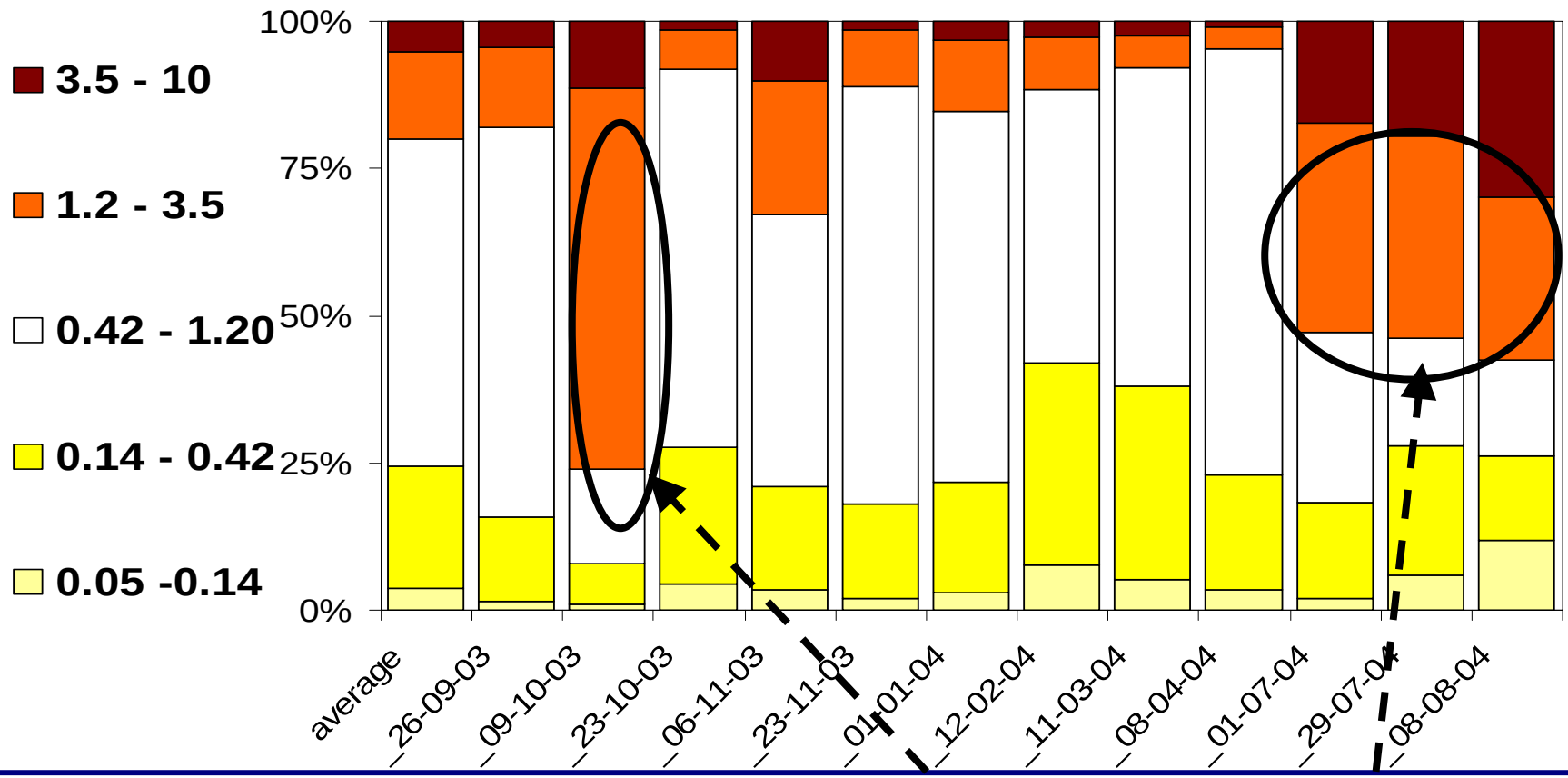
- **15 – 20% sea salt (Na, Cl, Mg)**

(total $PM_{10}$ = 22.4 µg/m³)

**Annual average Sea salt in $PM_{10}$**
(8-2003 – 4-2004):
**3%** urban traffic
5% urban background (2-2004)



# Nitrate (BERNER)




- **Coarse $NaNO_3$** 1.2 - 10 µm particle diameter (77% 9-10-2003) + in summer
- **Air masses from the sea 9-10-03**; 6-11-03; 29-7-04; (**not** 1-7-04 and 08-08-04)
- **Sea salt reacting on aerosol particles** with $HNO_3$ to **coarse $NaNO_3$**) $NaCl + HNO_3 \rightarrow NaNO_3 (s) + HCl (g)$ ⬆

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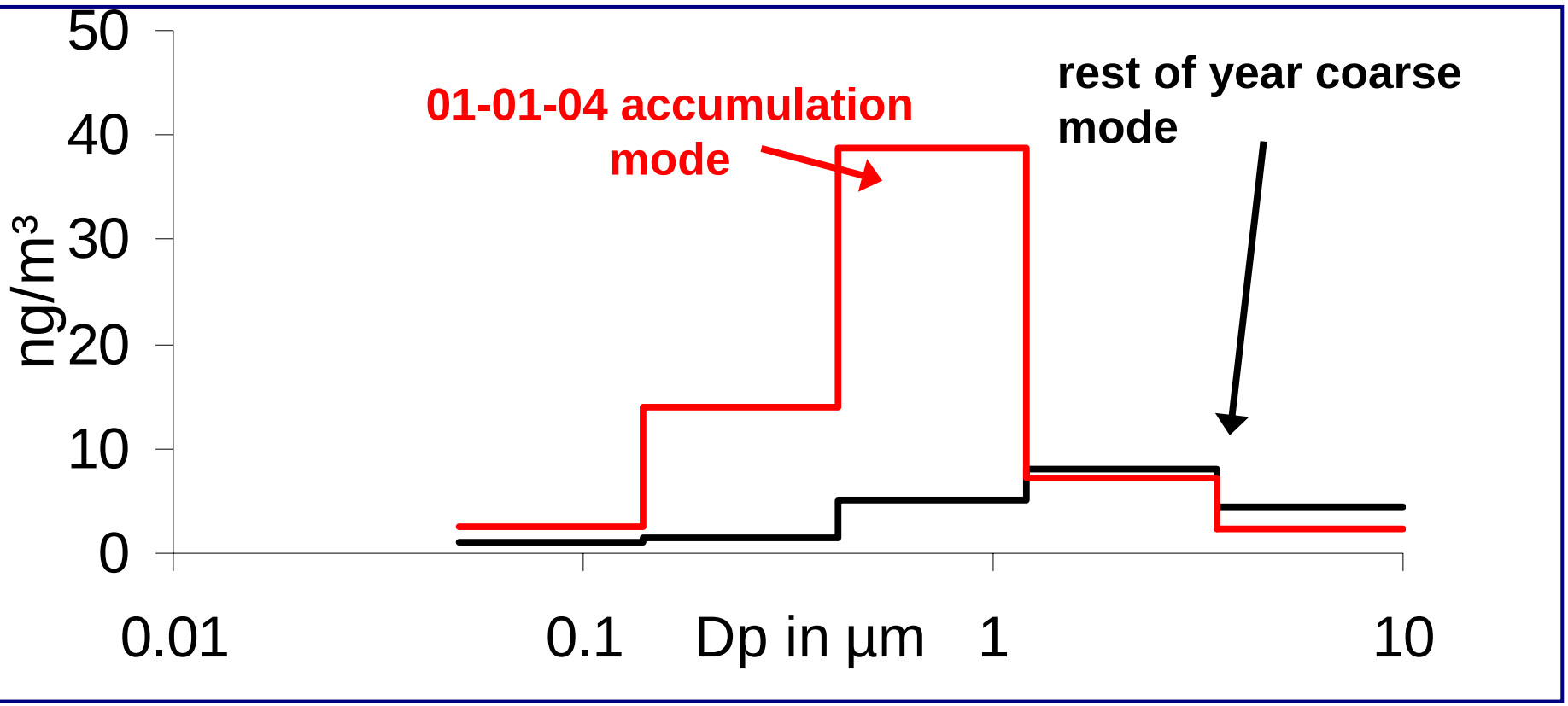
# New Year's Day compared to the rest of year

higher concentrations in $PM_{10}$ of
strontium(93), potassium(23), magnesium(6), lead(6), copper(3)

**maximum of copper in:**



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- **Characterisation: soot increased** with **decreasing** particle **size**
  **Na, Cl, Mg** respectively the earth's crust material in **coarse** mode
  **ammonium, sulphate and nitrate** mainly in **accumulation** mode
- **Soot concentration at roadside**
  **before** heating period **max: 50 - 140** nm particle diameter (cars)
  **during** heating period **max: 420 – 1200** nm particle d. (domestic heating)
- 3 distribution groups with **max. coarse, accumulation or several**
- **Sea salt**
  9-10-2003 air masses from North Sea reached Dresden
  **3% in $PM_{10}$** at traffic station; high amount of coarse nitrate
- **New Year's Day higher concentrations** in $PM_{10}$ occur
  + **shift to accumulation mode** magnesium(6), copper(3), strontium(93)

**interpretations** regarding **$PM_{10}$ + $PM_{2,5}$** with HVS:
**EAC-Poster**: Near traffic source apportionment in the City of Dresden
**full report** at www.umwelt.sachsen.de/lfug/luft-laerm-klima_5356.html

# Acknowledgements


- Department **Umwelt Service**, **TÜV** Bau und Betrieb GmbH, Dresden, Dr. Bittner
  - › Analytics of $PM_{10}$ und $PM_{2.5}$ filter
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  Mr. Lohberger, Dr. Müller et al.
  - › Sampling $PM_{10}$ and $PM_{2.5}$
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  - › Financing the project