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Ultrafine particles in NRW – case studies in urban background and at an „Autobahn“

UFIPOLNET-Conference

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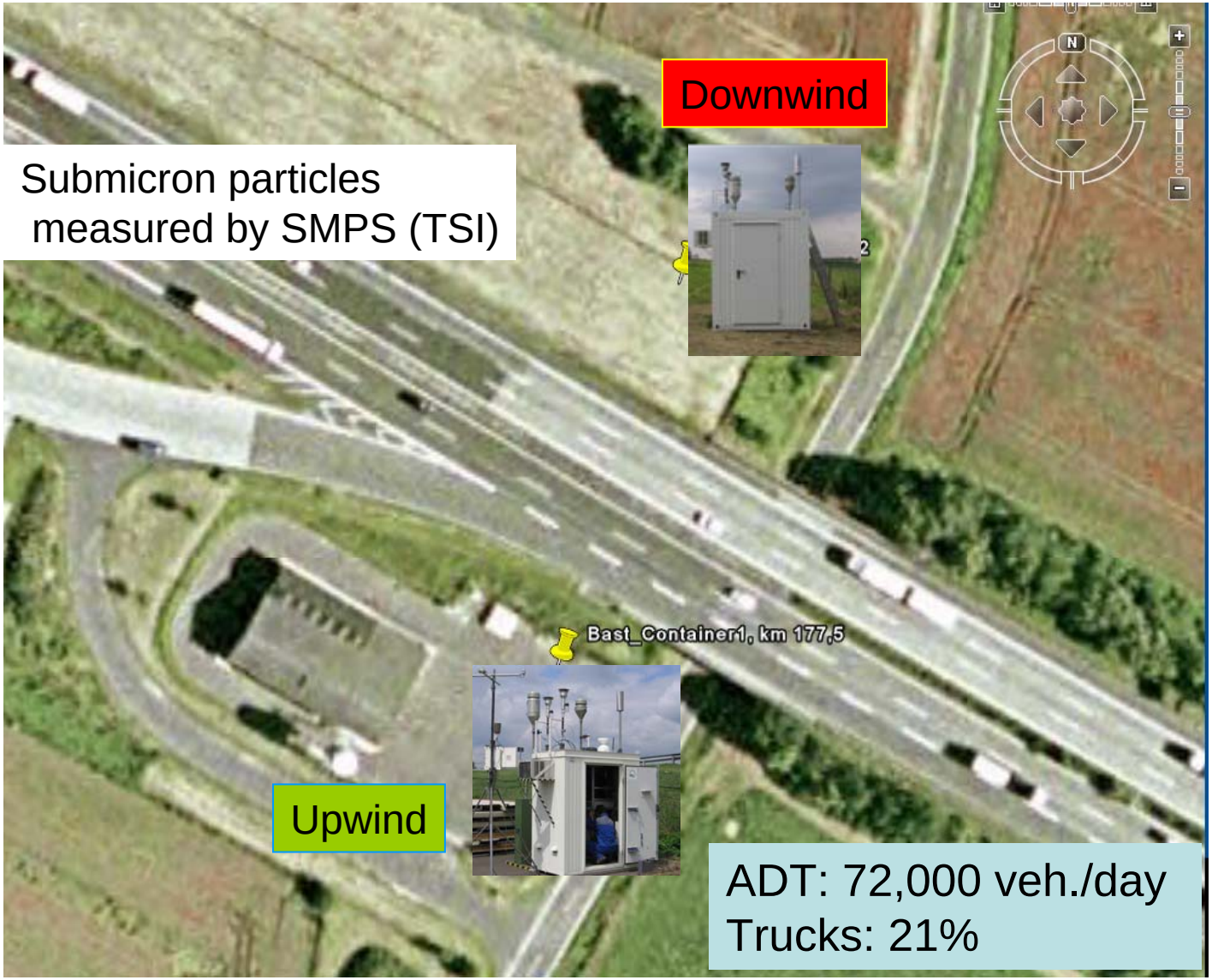
Content

- „Autobahn“ measurements
  (A 61 near AK Meckenheim, winter 2006)
- Urban measurements
  (Duisburg, 2002)
- Conclusions

“Autobahn” measurements: sites

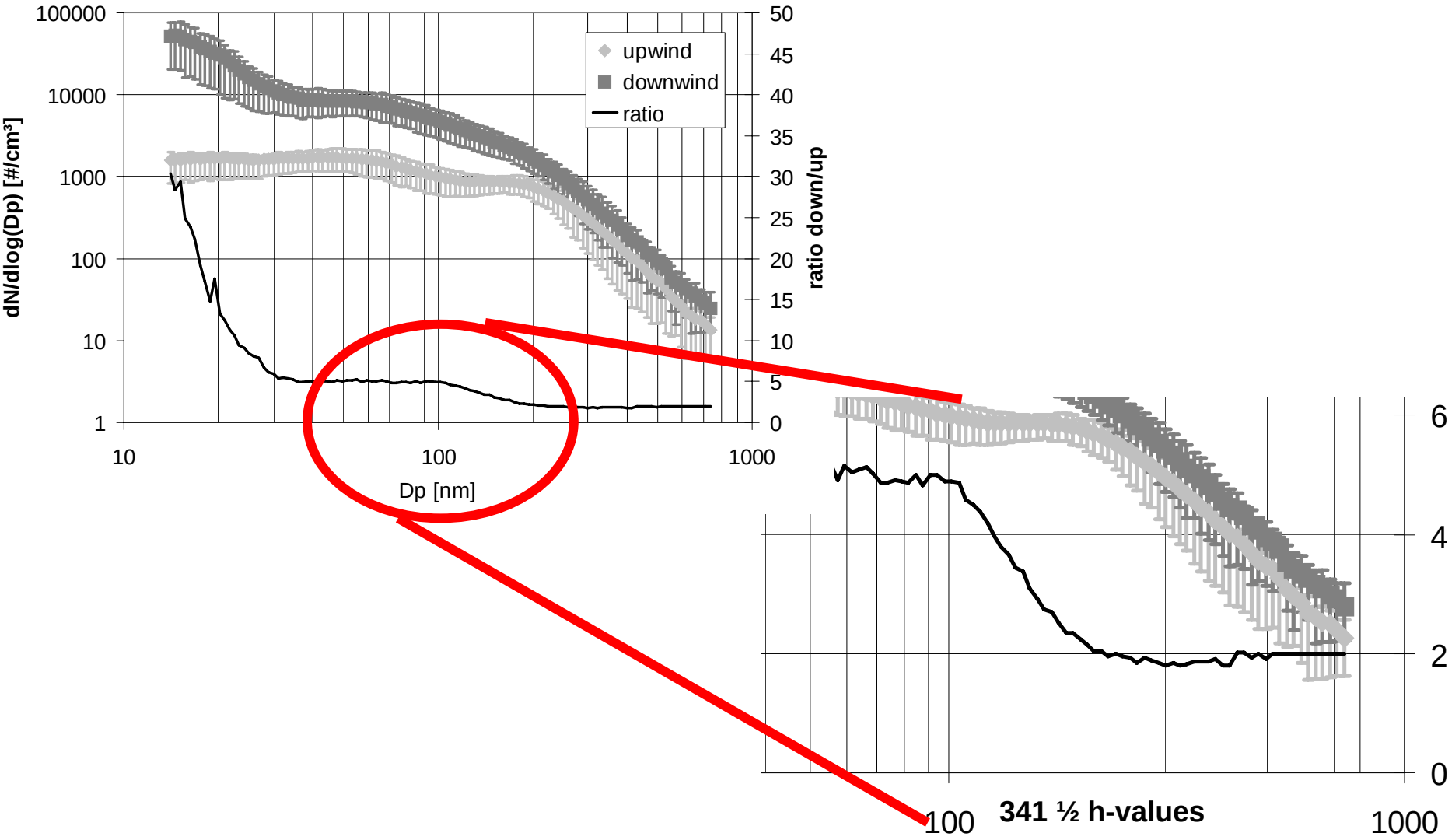


“Autobahn” measurements: Mass concentrations

Measured upwind, downwind &
„add-on“ mass concentration
[µg/m³]

	TEOM (4505 ½h values)			Filter (N=68)		
	upwind	downwind	Δ	upwind	downwind	Δ
PM_{10}	15.2	19.7	4.5	16.6	20	3.5
PM_{1}	8.6	11.6	2.9	9.7	11.7	2.0
PM_{1-10}	6.5	8.1	1.6	6.9	8.3	1.4

“Autobahn” measurements: - number size distribution



“Autobahn” measurements: Traffic contributions

	Number conc.		mixing ratio	
	UFP	50-200nm	NO	NO2
	#/cm³	#/cm³	ppb	ppb
upwind	1916	923	0.7	5
downwind	17369	3177	38.3	16.3
traffic related	15453	2254	37.6	11.3
Traffic contribution to downwind	89%	71%	98%	69%

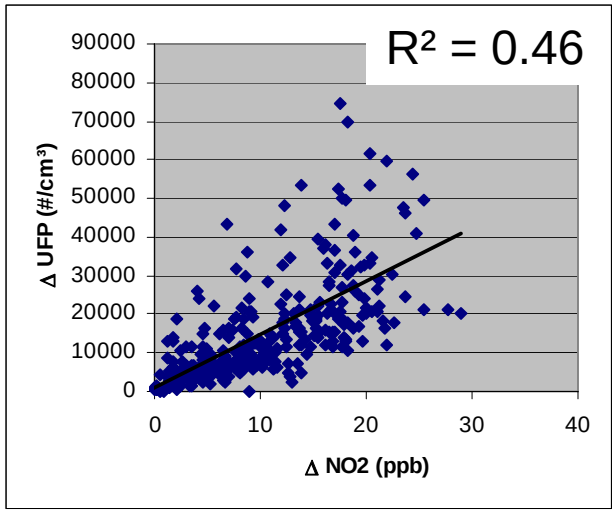
341 ½ h-values

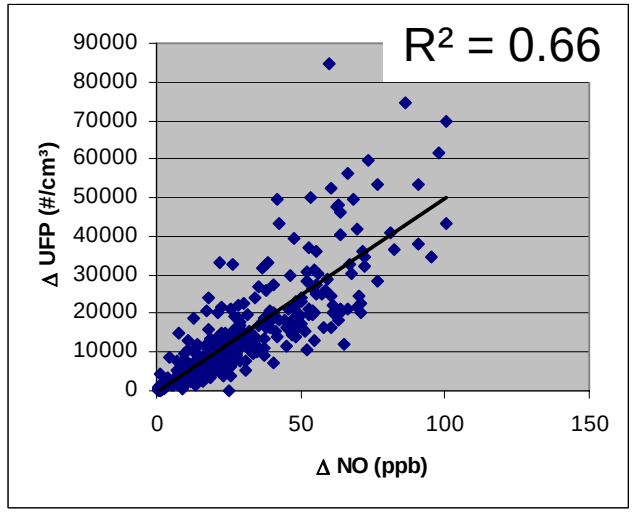
“Autobahn” measurements: – Correlation between particle number and nitrogen oxide conc.

NO2

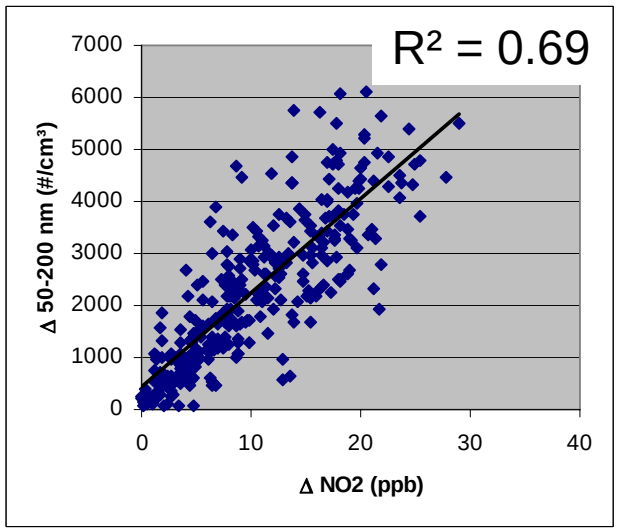
NO

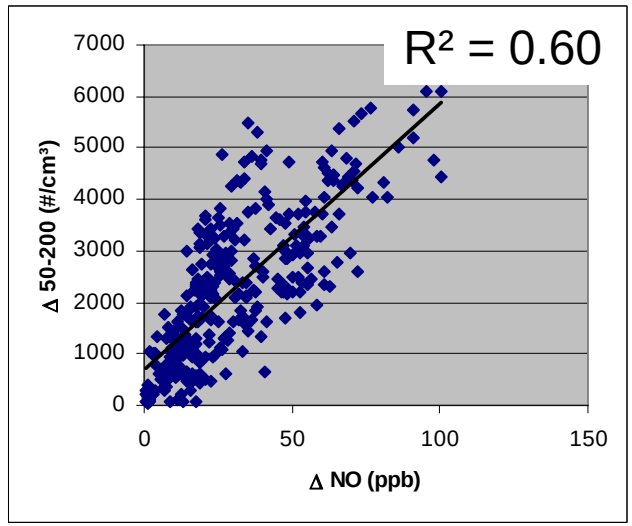
UFP





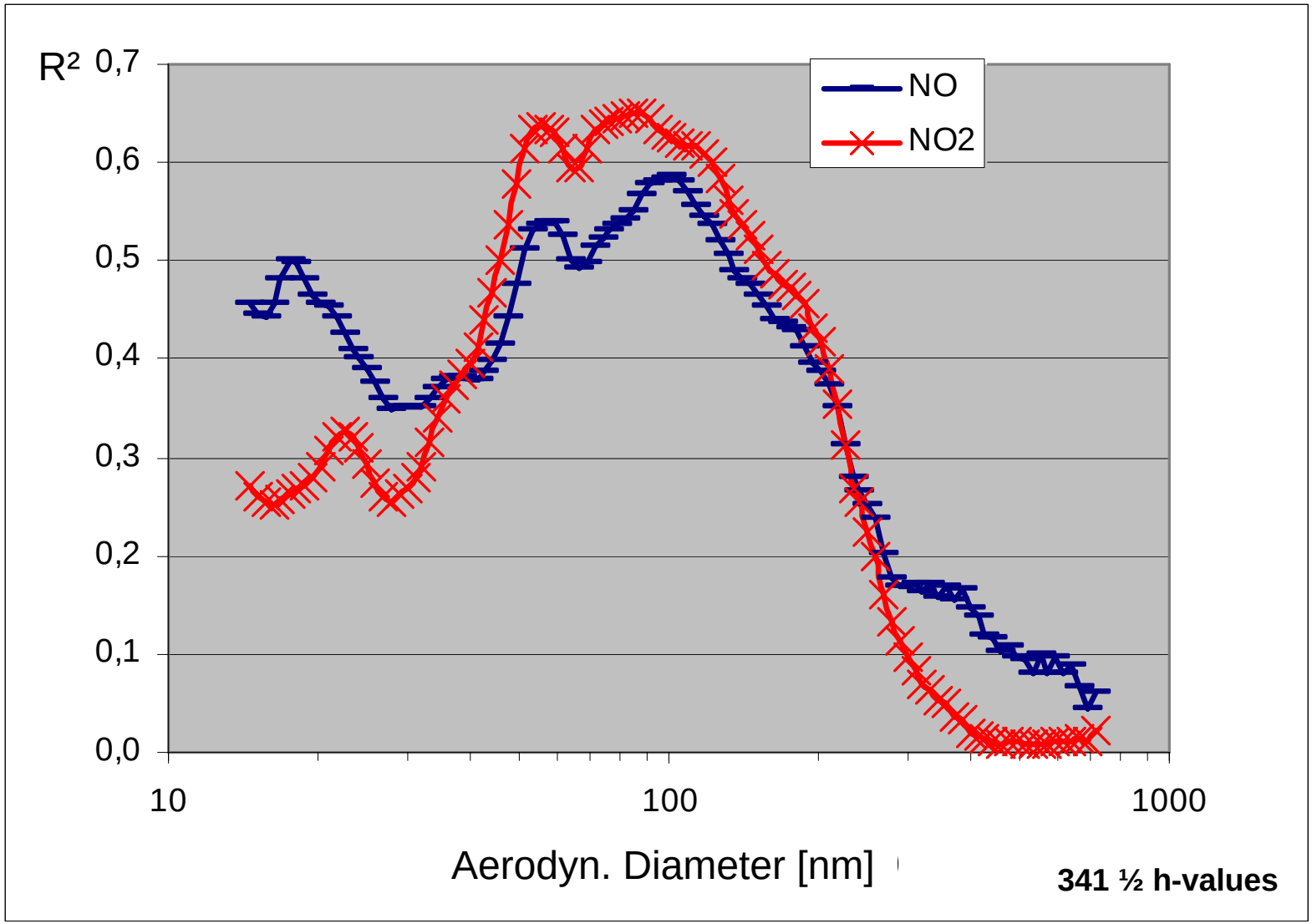
50-200 nm



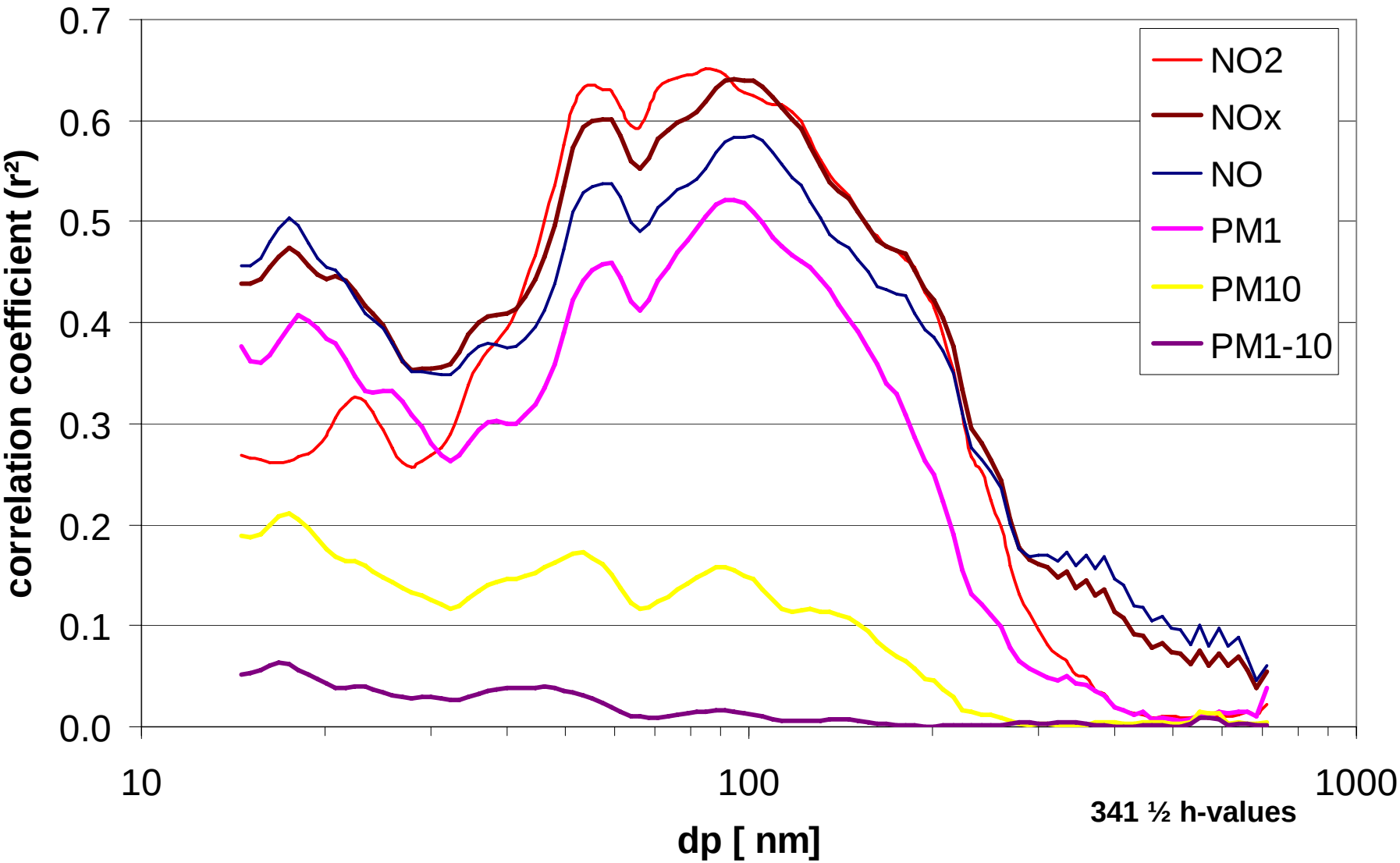


341 ½ h-values

“Autobahn” measurements:– Correlation between particle number and nitrogen oxide conc.



“Autobahn” measurements: – Correlation between particle number and pollutant conc.

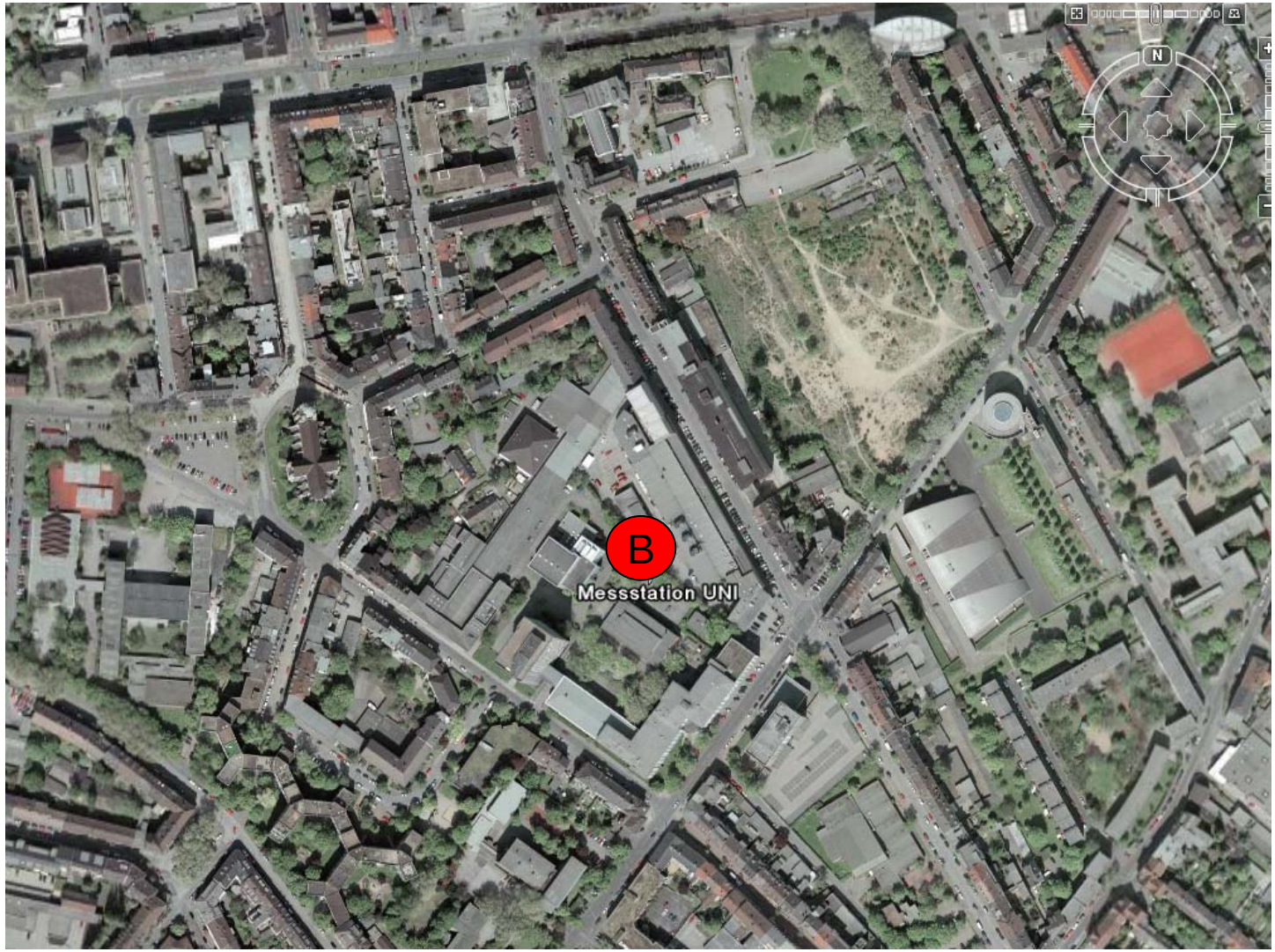


“Autobahn” measurements: Summary

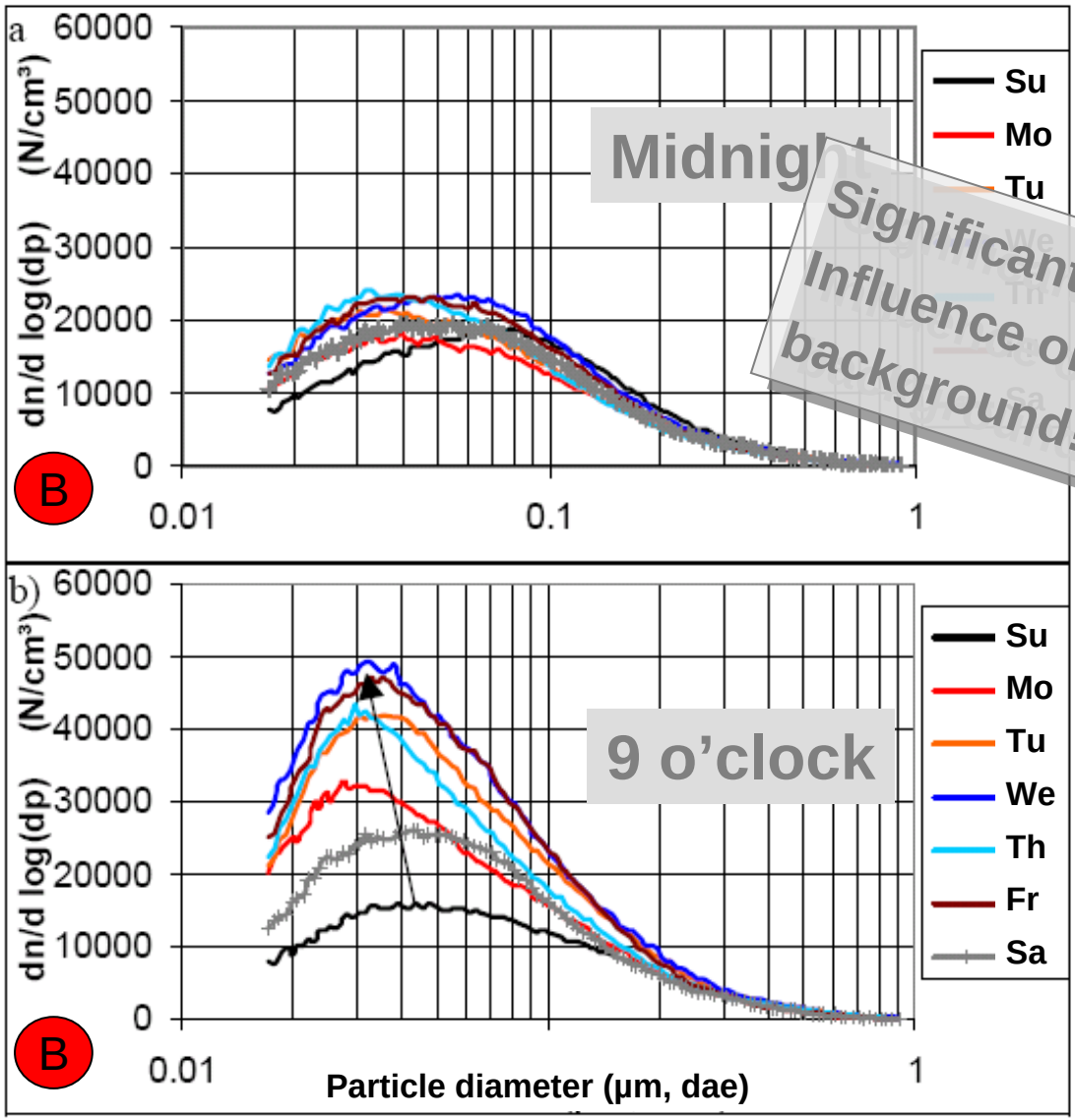
- Upwind/downwind SMPS measurements
- Low background of fine and ultrafine particles
- Emissions of particles over the whole size range
- Change of size distribution for UFP (<40nm): probably condensed organic compounds
  ➔ best correlation with NO
- Change of size distribution around 100-200 nm: probably diesel particles
  ➔ best correlation with NO2, less with NO/PM1
- No correlation with PM10 or coarse mass conc.

Urban background measurements

Surroundings of urban background site B

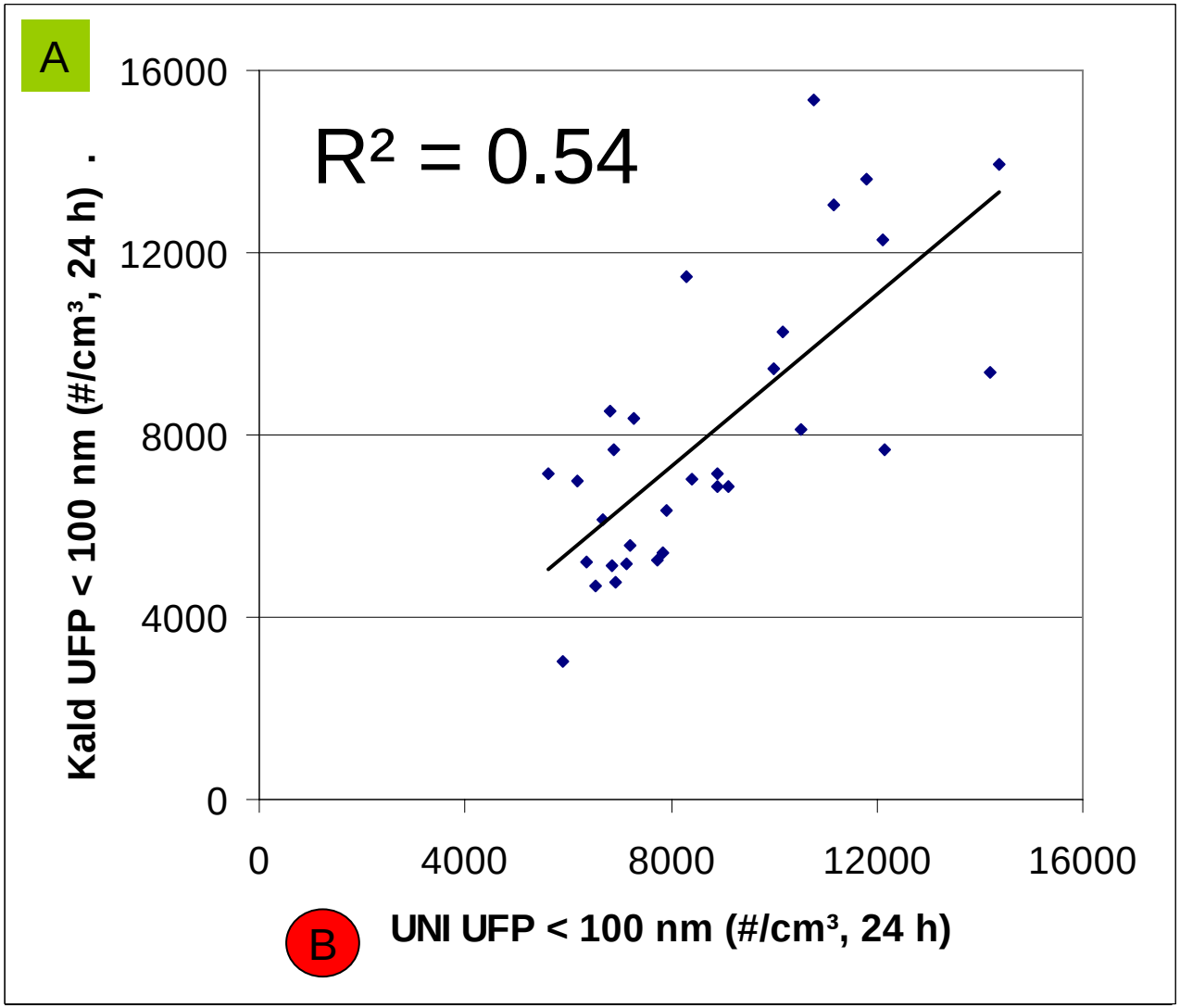


Particle number distribution at urban background site B

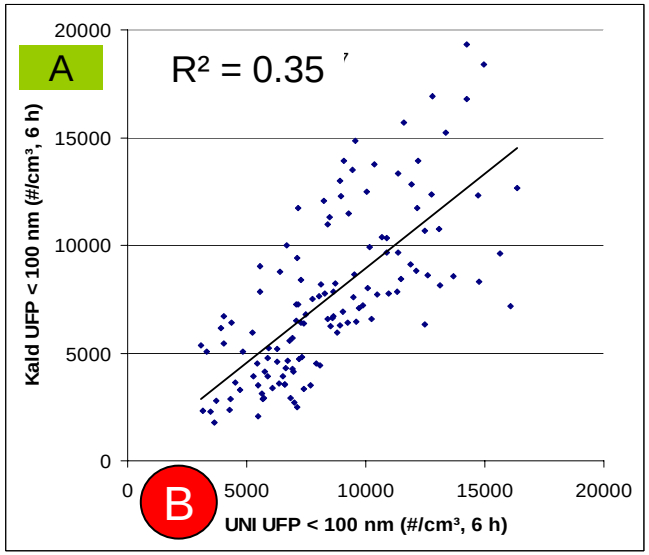


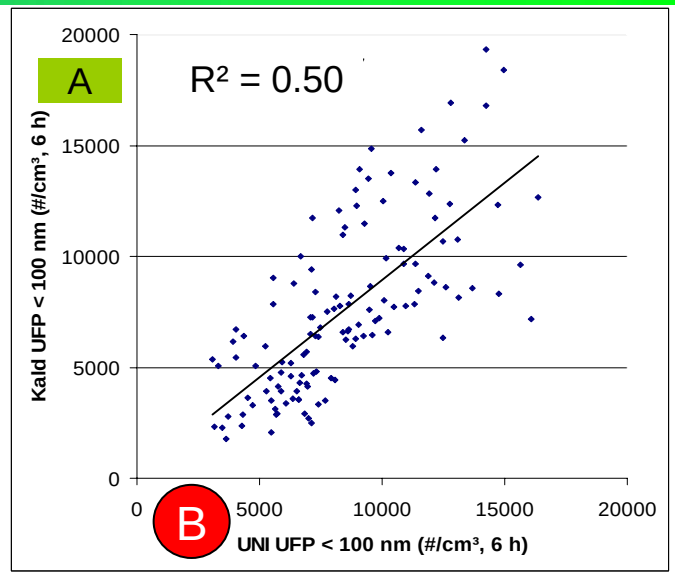
Significant anthropogenic Influence on UFP's at urban background!

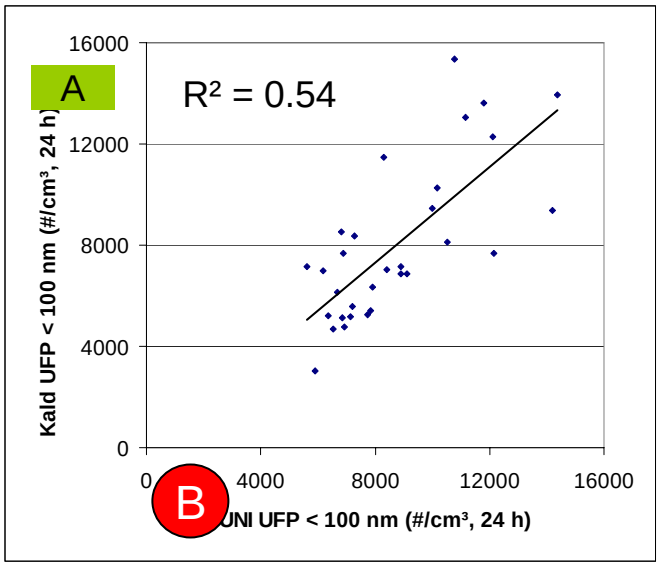
Quass et al., 2004

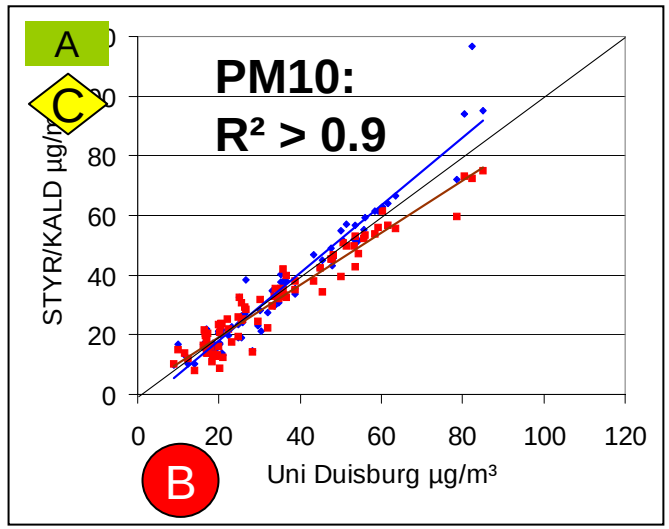

A
R² = 0.54
16000
12000
8000
4000
0
Kald UFP < 100 nm (#/cm³, 24 h) .
0
4000
8000
12000
16000
B
UNI UFP < 100 nm (#/cm³, 24 h)

Ultrafine particles: spatial/temporal correlation









Conclusions

- Traffic clearly contributes to UFP concentrations
- Urban number concentrations always higher than at upwind „Autbahn“site (rural)
  ➔ significant emissions even at nighttime
- Strong variation with time (daily and weekly)
  ➔ anthropgenic influence, mostly traffic
- Spatial inhomogeneity much higher than for mass concentrations
  ➔ to be taken into account for exposure assessment

Acknowledgements

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NRW.

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Thanks for your attention!

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