



A nest for every region: Chemical Transport Modeling for exposure assessment

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Overview

- The EURAD Model
- Participation at the DFG Project **“Temporal patterns of changes in inflammatory markers in response to different air pollutants and their role as intermediates in coronary atherosclerosis”** in cooperation with Universitätsklinikum Essen, Institut für Medizinische Informatik, Biometrie und Epidemiologie (IMIBE)
- Delivery of exposure data from European scale down to urban scale (Rhine-Ruhr area)
- Sensitivity studies on emissions



The EURAD Model

- Model experience in air quality over more than 25 years
- Since 2001: operational forecast of air quality www.eurad.uni-koeln.de
- Data assimilation of observed values
- Participation at national and international projects

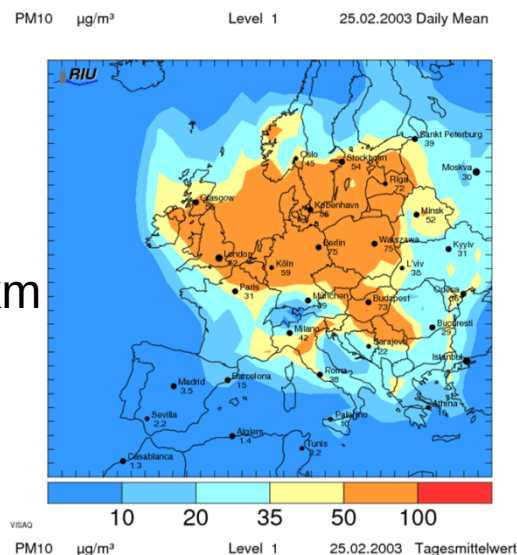


Temporal patterns of changes in inflammatory markers in response to different air pollutants and their role as intermediates in coronary atherosclerosis

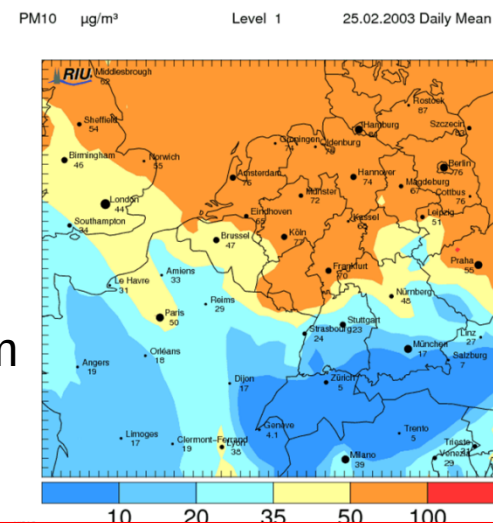
- Provision of exposure data:
- Mainly: O₃, NO₂, PM₁₀, PM_{2.5}, PM_{1.0}, particle densities
- For cohort study (4809 probands)
 - 1. phase: Oct 2000 – Dec 2003
 - 2. phase: Jan 2006 – Dec 2008

Model domains

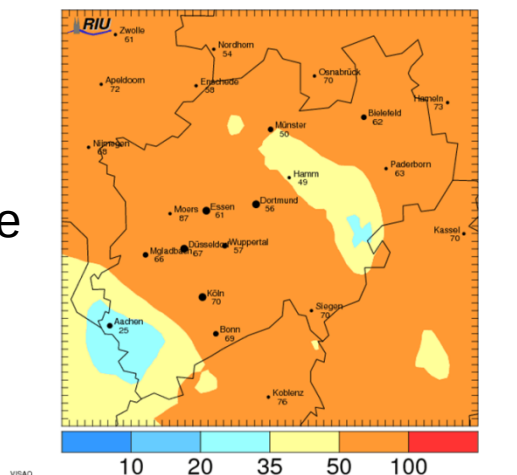
Europe
Ds=125 km



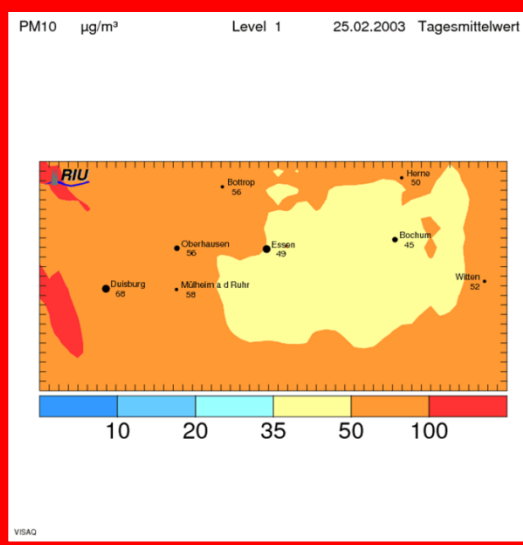
Central
Europe
Ds=25 km



Northrhine
Westfalia
Ds=5 km



Rhine-
Ruhr
Ds=1km





Yearly averages in the urban area

Comparison: base forecast – analysis
Comparison : year to year



Data Assimilation: monitoring stations





Yearly average: PM10 2006

PM10 $\mu\text{g}/\text{m}^3$

Level 1

2006

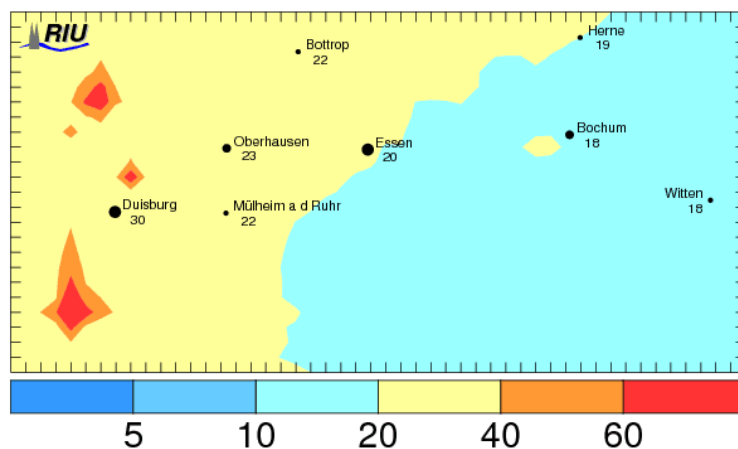
Jahresmittelwert

PM10 $\mu\text{g}/\text{m}^3$

Analysis

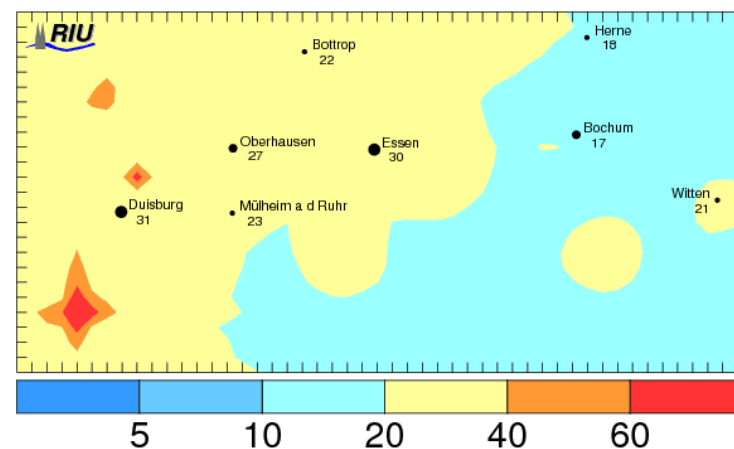
2006

Jahresmittelwert



VISAQ

Forecast



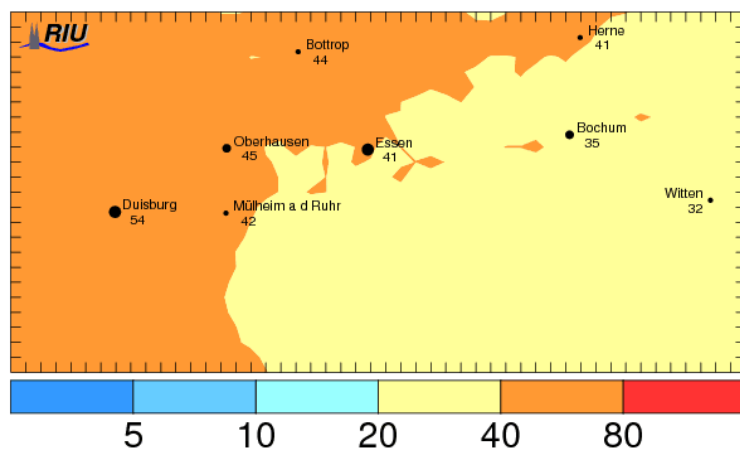
VISAQ

Analysis



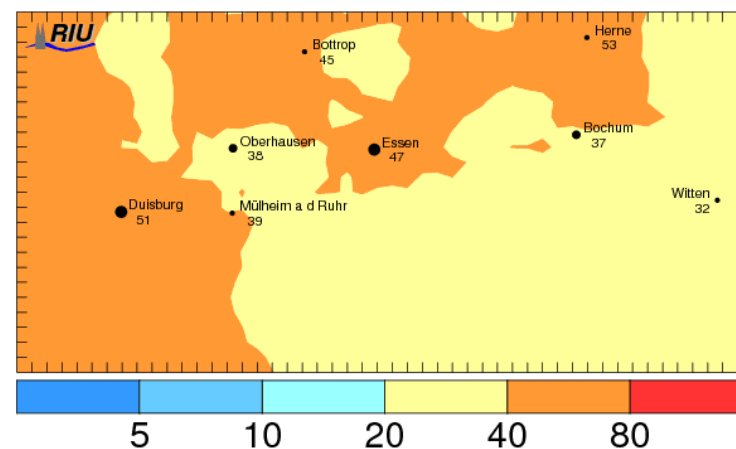
Yearly average: NO₂ 2007

NO₂ $\mu\text{g}/\text{m}^3$ Level 1 2007 Jahresmittelwert NO₂ $\mu\text{g}/\text{m}^3$ Analysis 2007 Jahresmittelwert



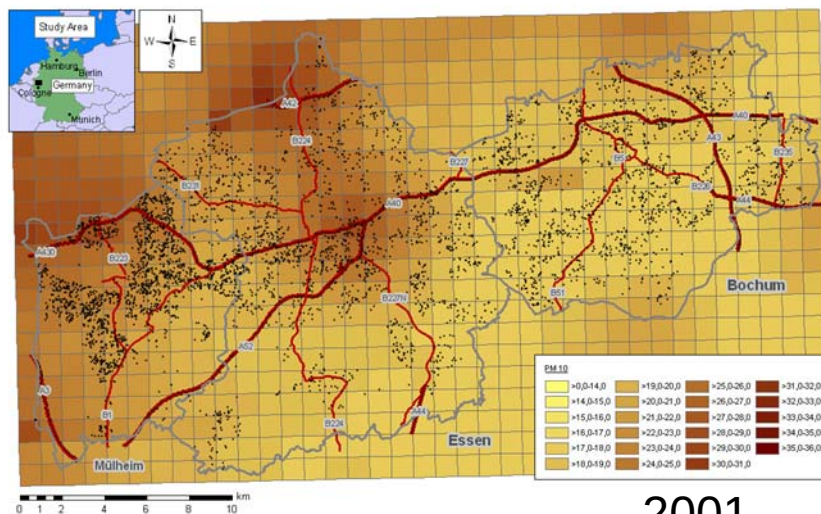
VISAQ

Forecast

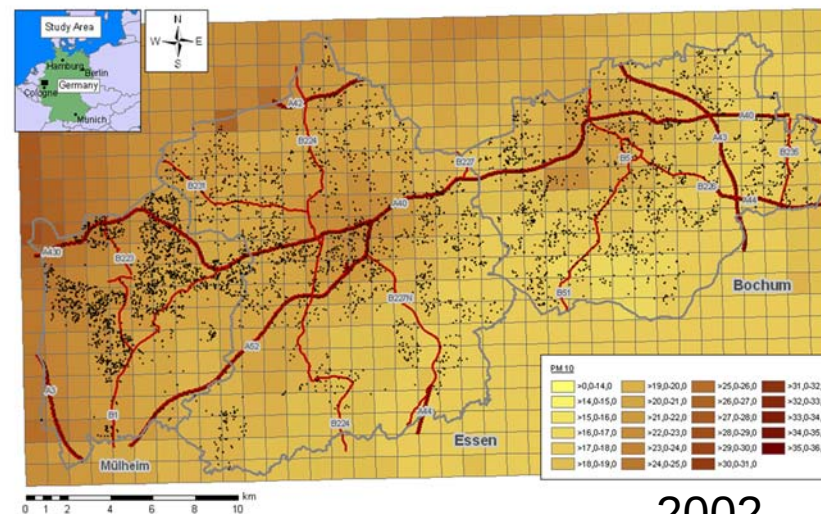


VISAQ

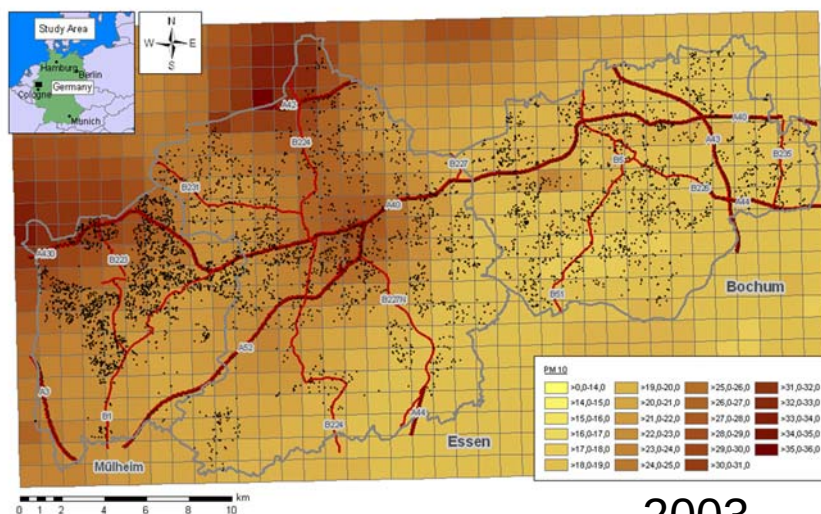
Analysis



2001

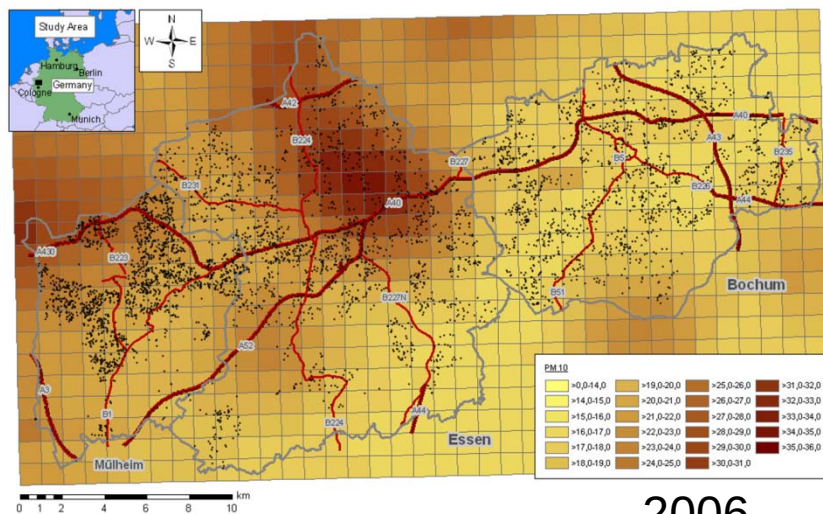


2002

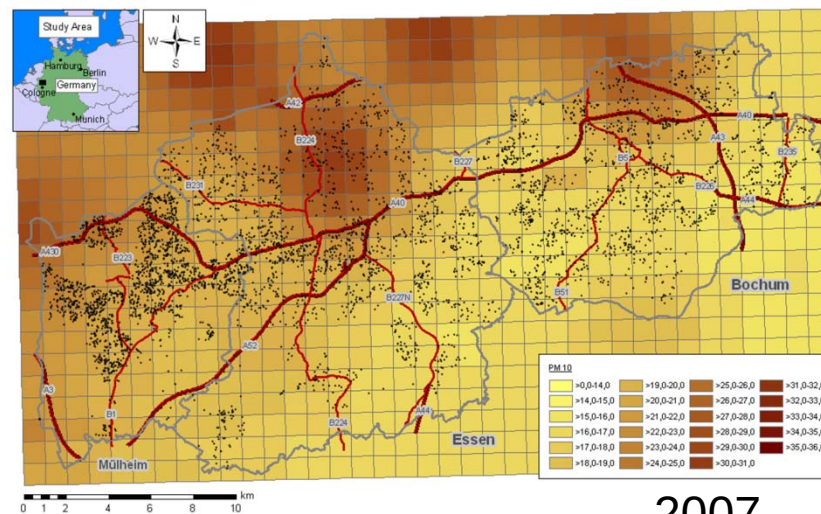


2003

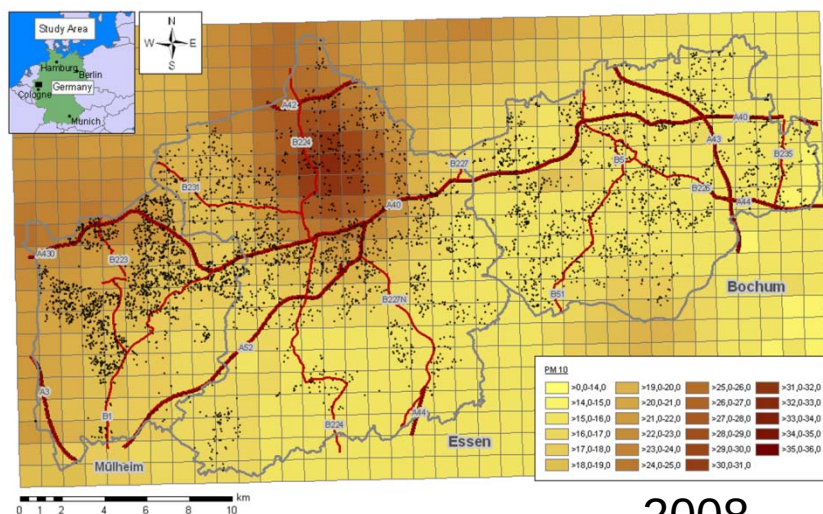
Yearly average PM10



2006



2007

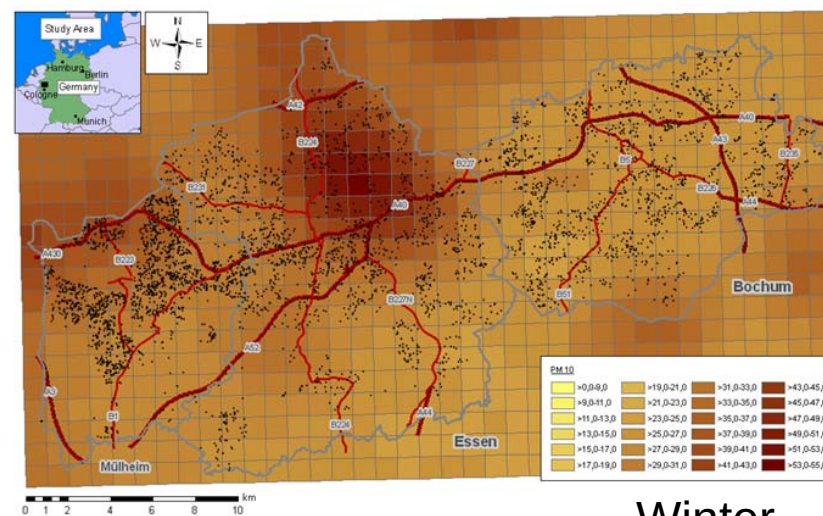
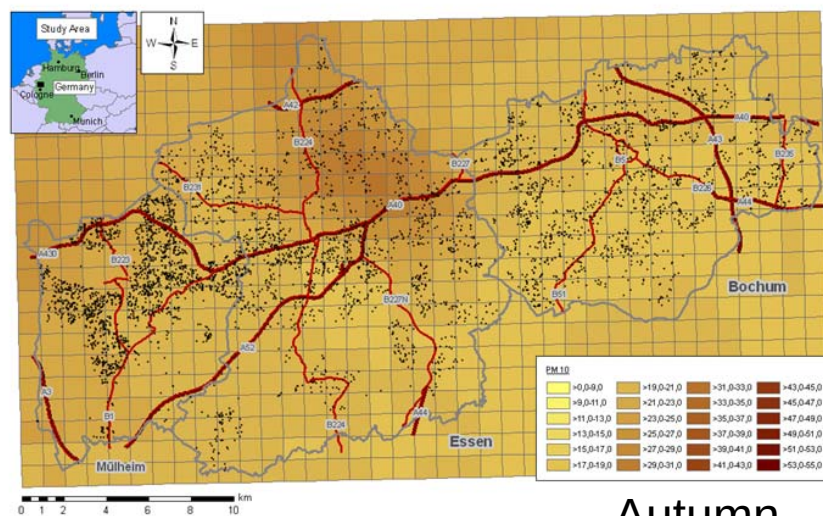
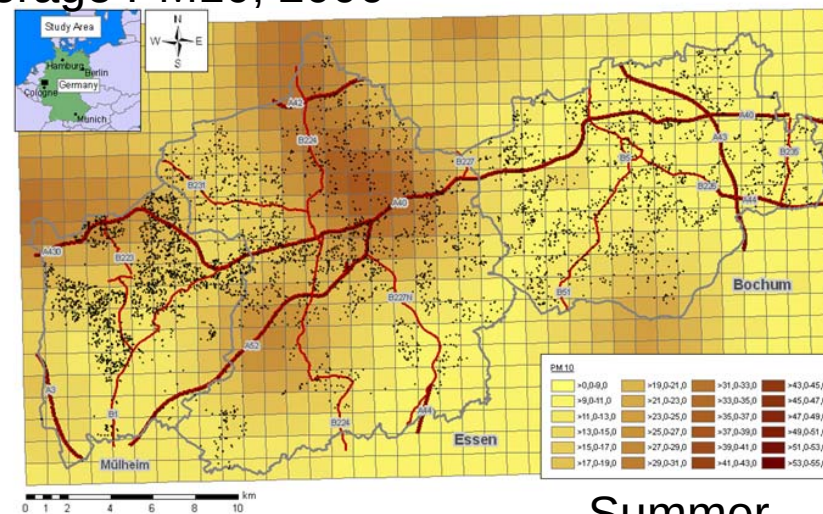
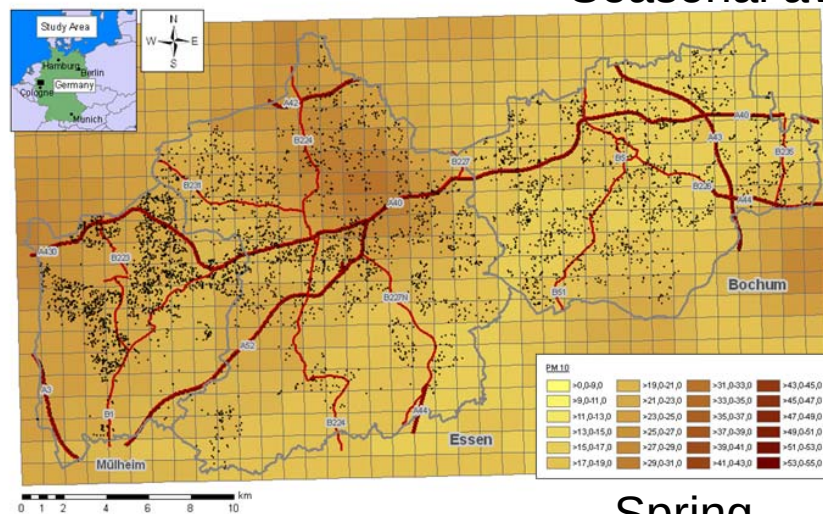


2008

Yearly average PM10

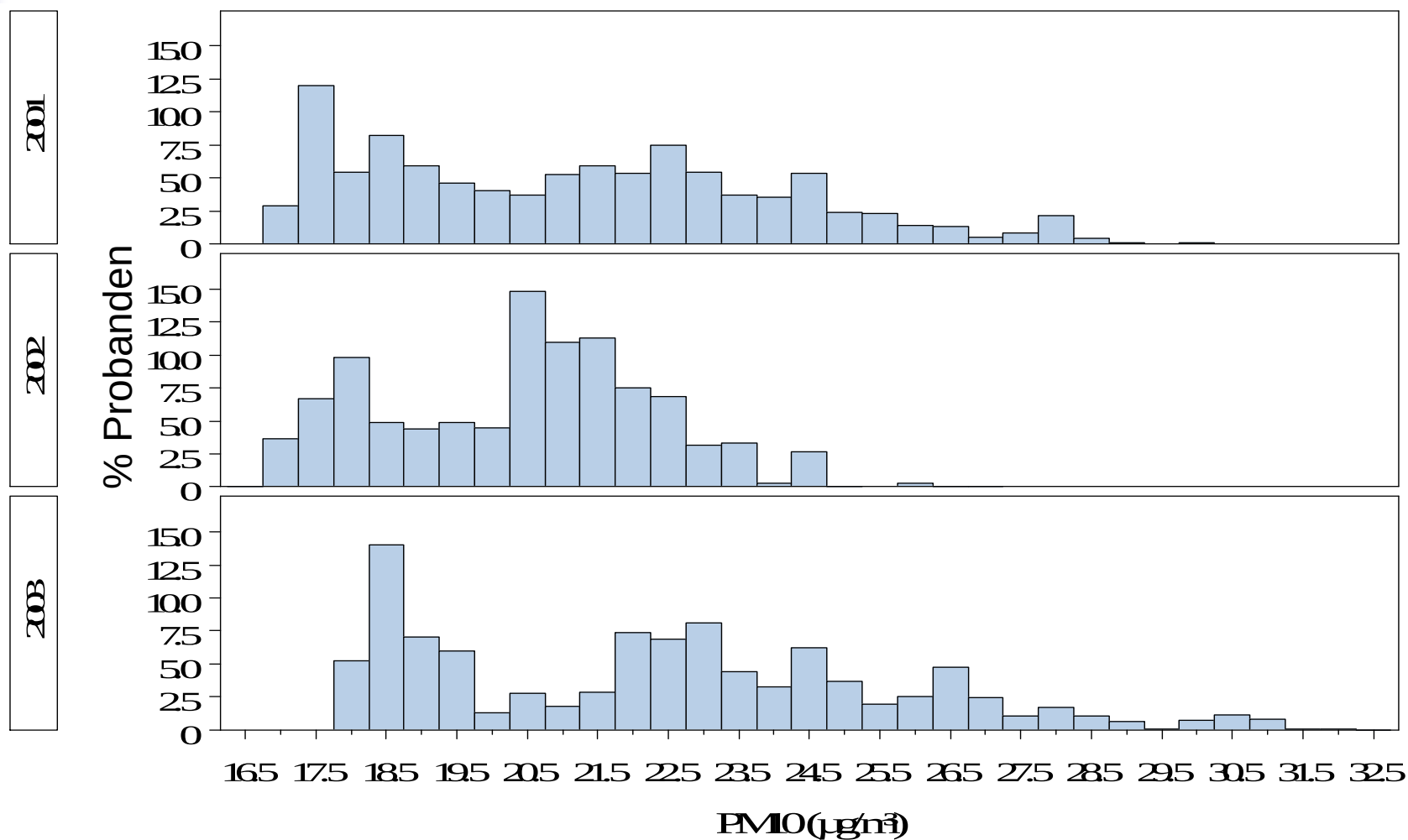


Seasonal average PM10, 2006



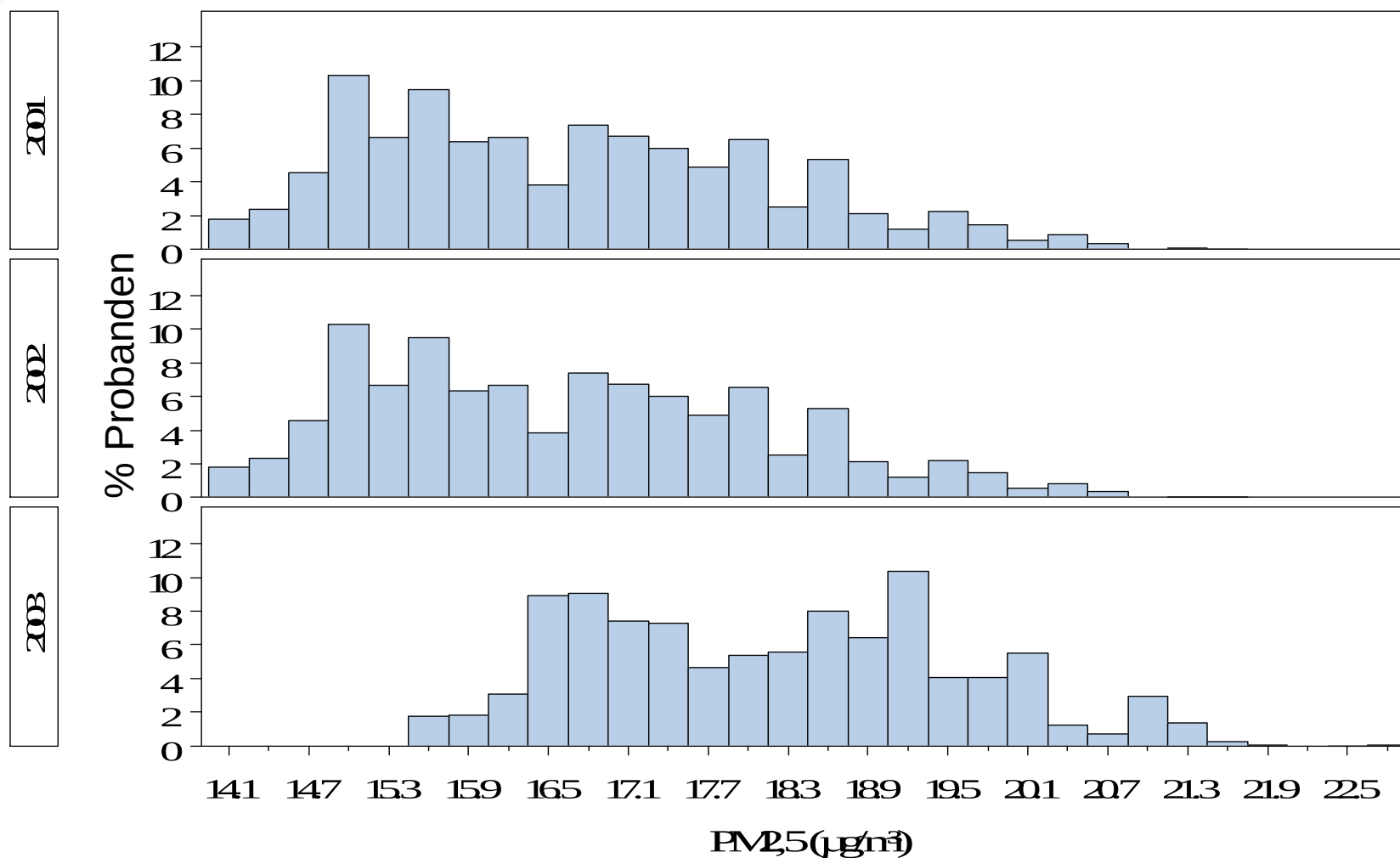


PM₁₀ (µg/m³) Exposition classification of the yearly averages



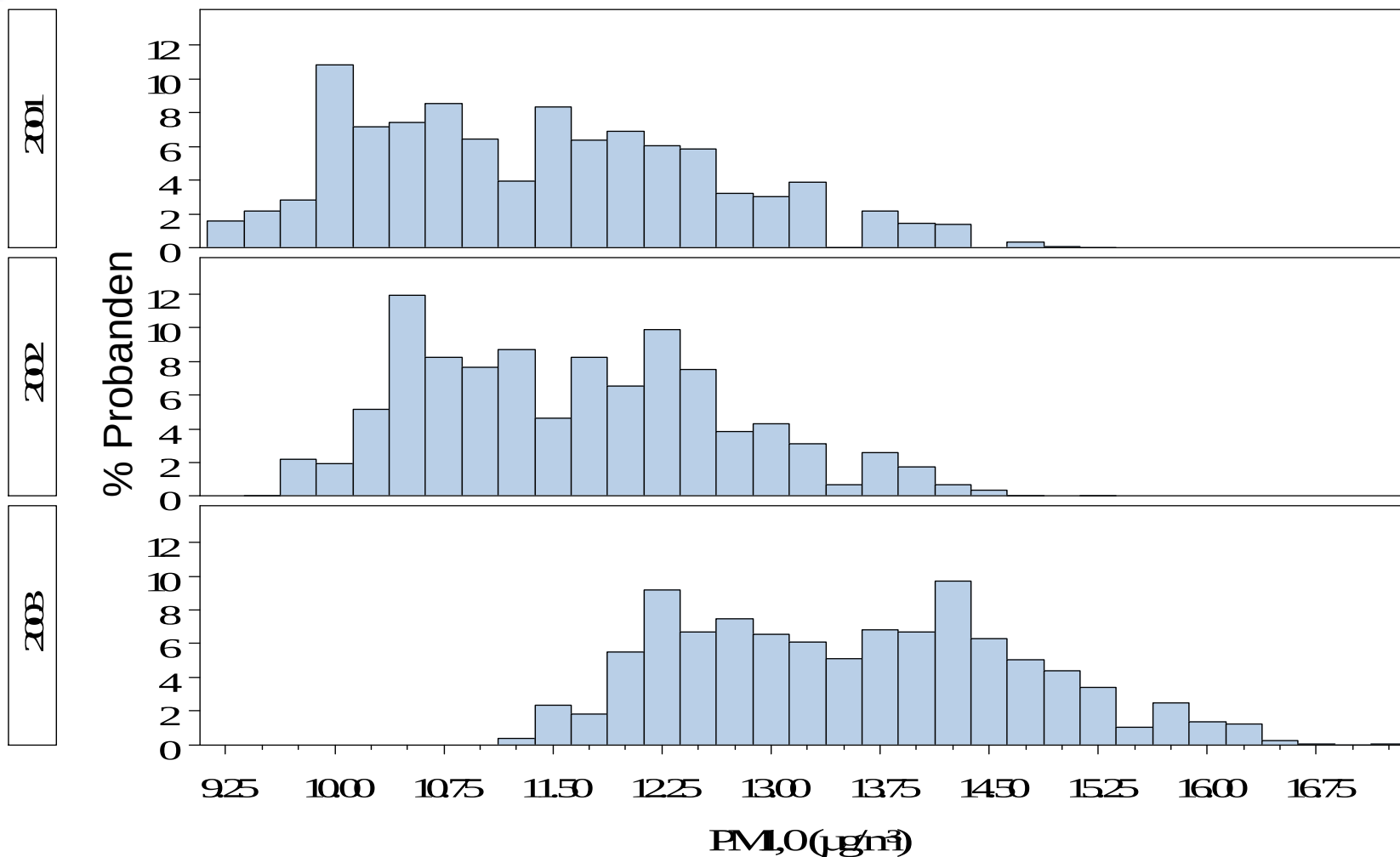


PM_{2.5} (µg/m³) Exposition classification of the yearly averages





PM_{1.0} (µg/m³) Exposition classification of the yearly averages





Sensitivity studies on emissions (only in the urban domain, 1 x 1 km)

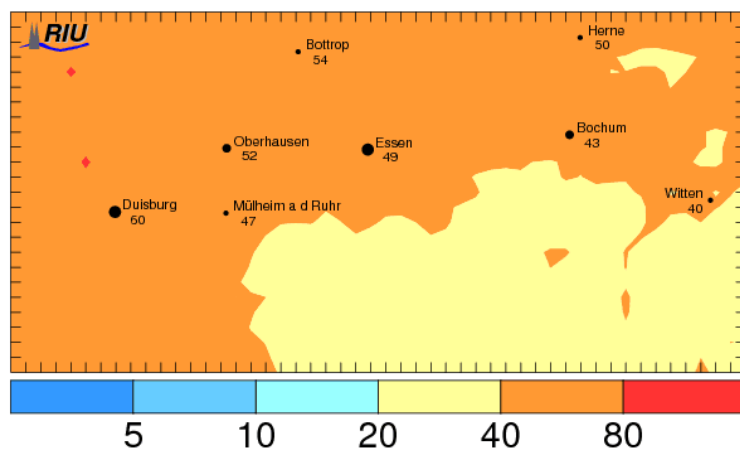
NoTra: No Traffic Emissions

NoInd: No Industrial Emissions



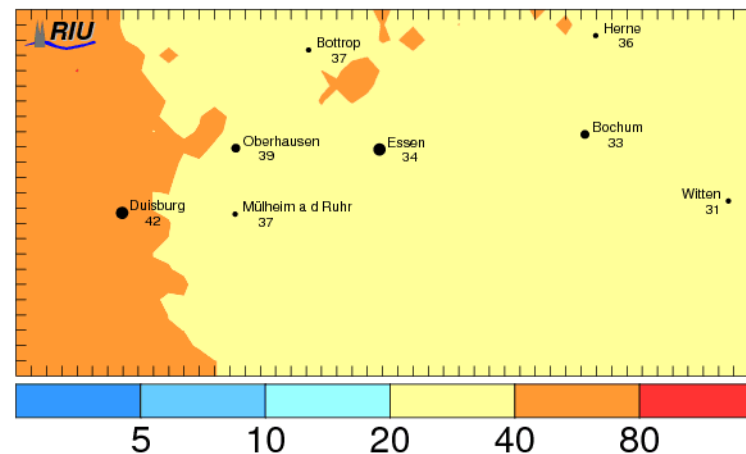
Yearly average NO₂, 2003

NO₂ µg/m³ Level 1 2003 Jahresmittelwert NO₂ µg/m³ Level 1 2003 Jahresmittelwert



VISAQ

Base run



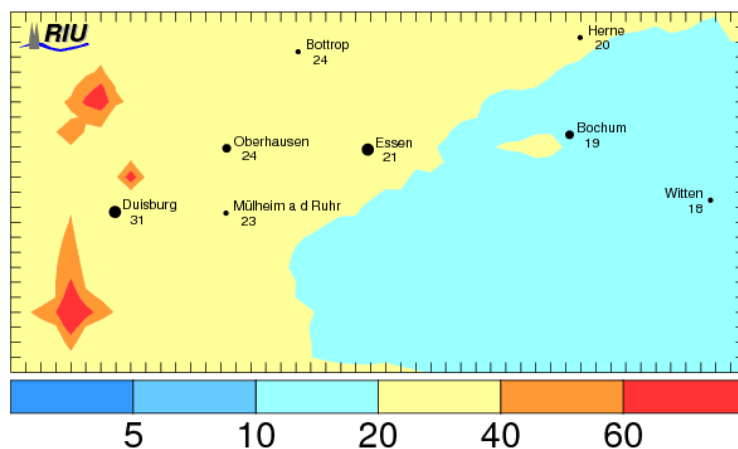
VISAQ

NoTra



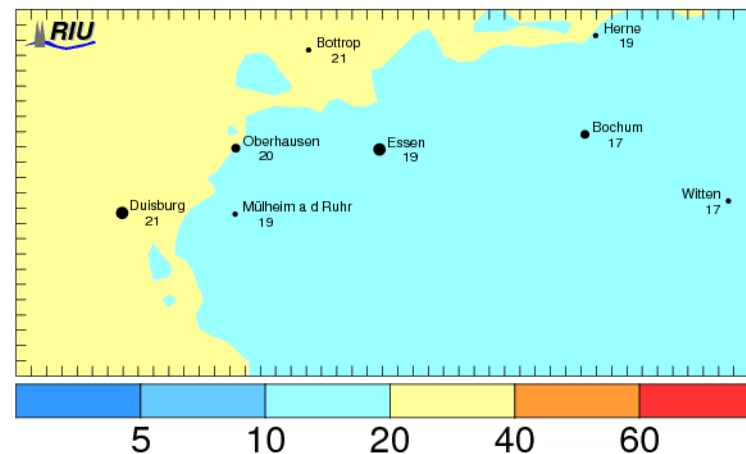
Yearly average PM10, 2003

PM10 $\mu\text{g}/\text{m}^3$ Level 1 2003 Jahresmittelwert PM10 $\mu\text{g}/\text{m}^3$ Level 1 2003 Jahresmittelwert



VISAQ

Base run

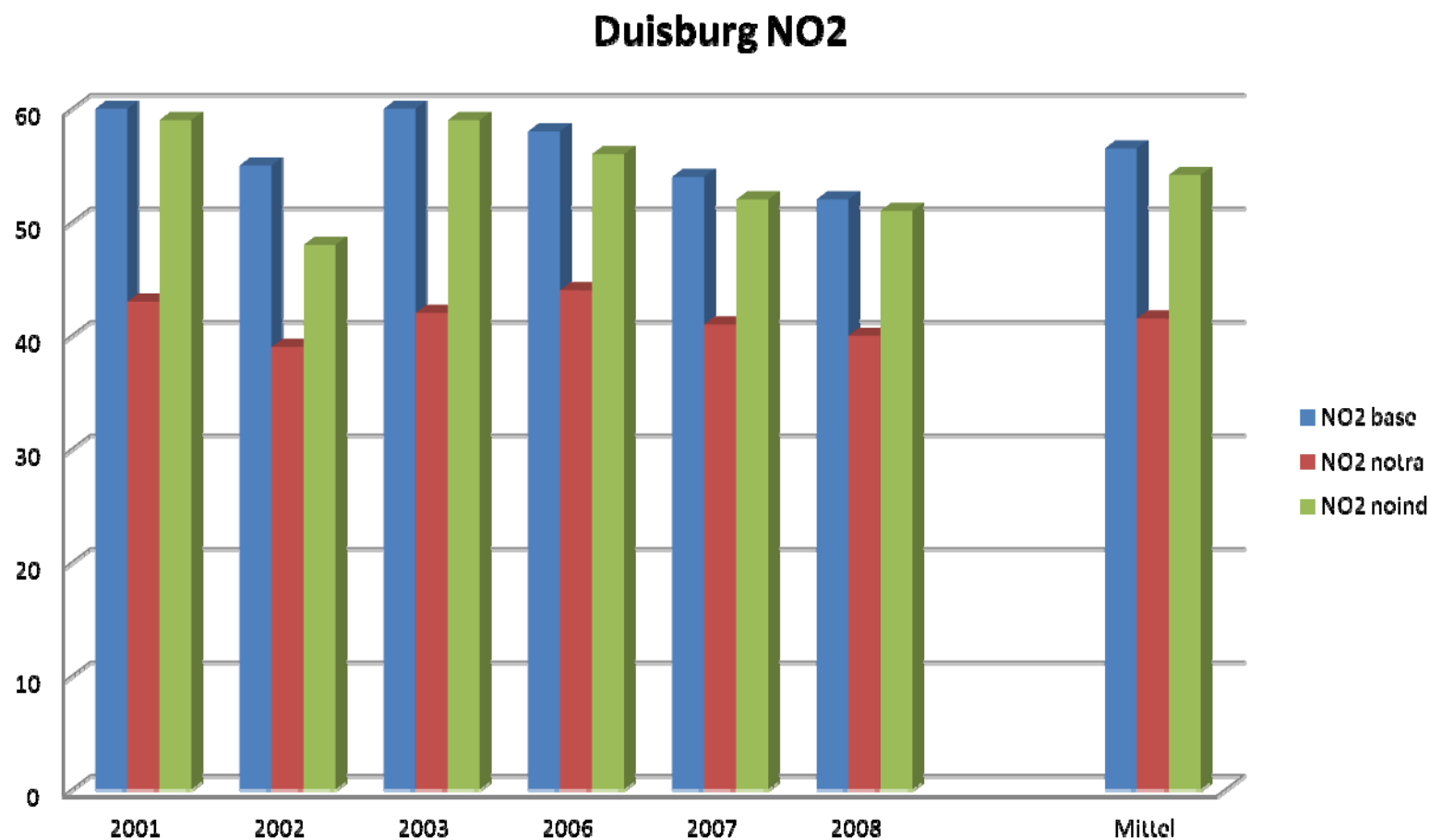


VISAQ

NoInd



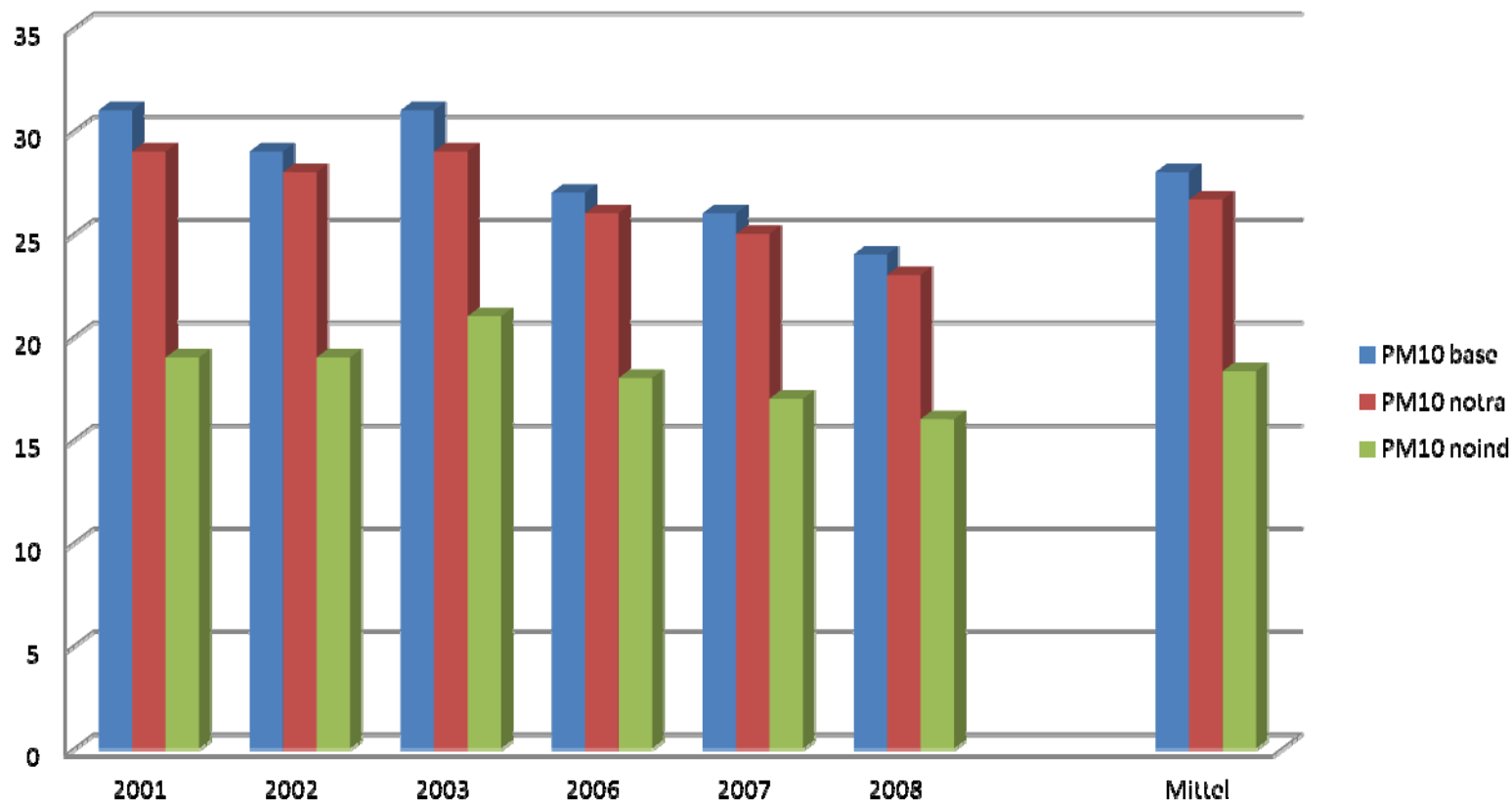
Yearly average NO₂, Duisburg





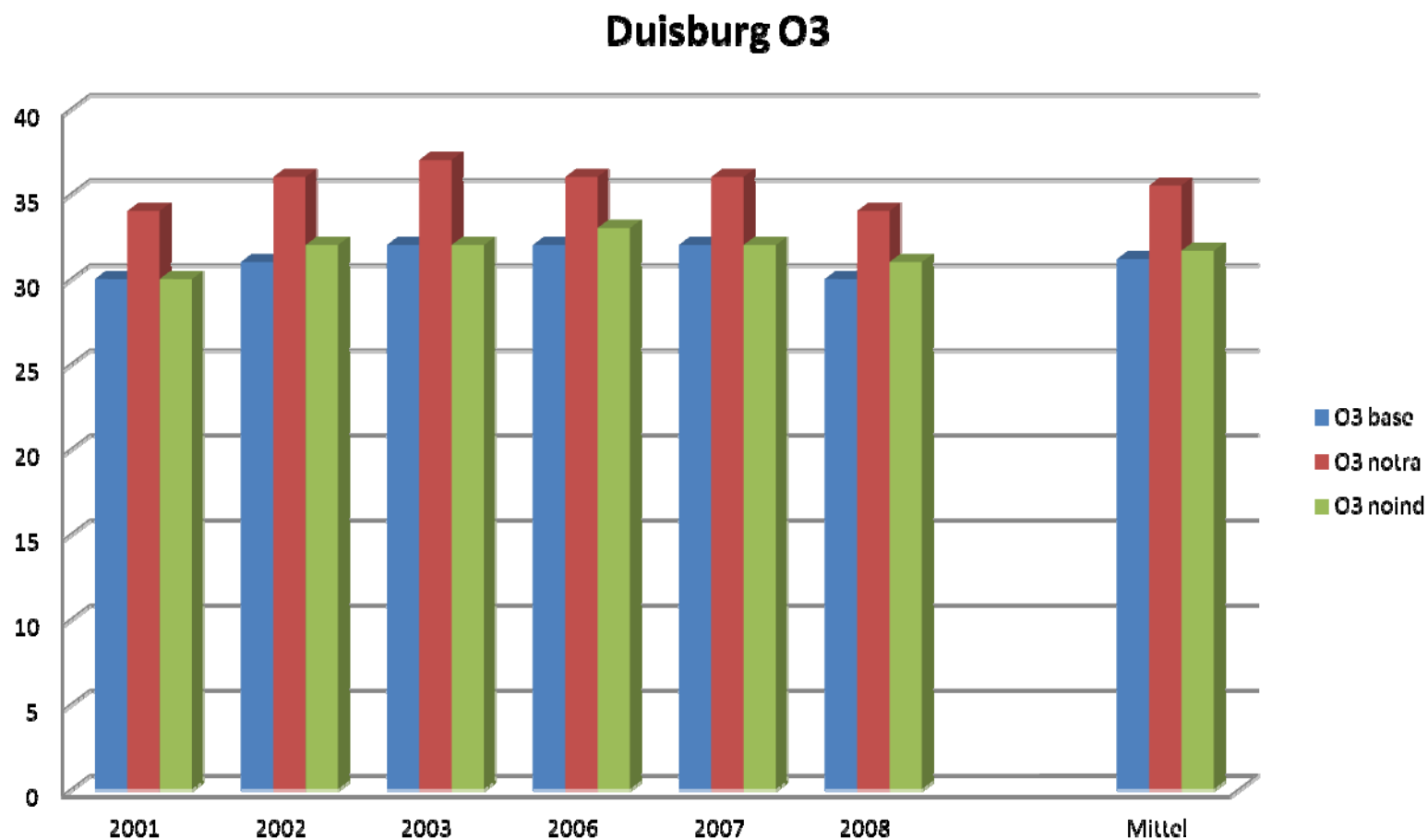
Yearly average PM10, Duisburg

Duisburg PM10





Yearly average O₃, Duisburg





**Sensitivity studies on emissions
(on all domains, only for 2001)
TotNoTra: No Traffic Emissions**



NO₂ (µg/m³), Duisburg

	Base	NoTra	TotNoTra	Red. Base-NoTra	Red.NoTra-TotNoTra
15.01.2001	78	46	27	-41%	-41%
15.04.2001	17	15	10	-12%	-33%
15.07.2001	25	19	16	-24%	-15%
15.10.2001	58	46	27	-21%	-41%
Avg 2001	60	43	29	-28%	-32%



PM10 ($\mu\text{g}/\text{m}^3$), Duisburg

	Base	NoTra	TotNoTra	Red. Base-NoTra	Red.NoTra-TotNoTra
15.01.2001	17	13	12	-24%	-8%
15.04.2001	5	4	4	-20%	0%
15.07.2001	24	24	21	0%	-12%
15.10.2001	28	23	23	-18%	0%
Avg 2001	31	29	26	-6%	-10%