



AFO 2000

Development and Validation of Tools for the Implementation
of European Air Quality Policy in Germany

VALIUM

A model system for the assessment of ambient air quality confirming EC directives

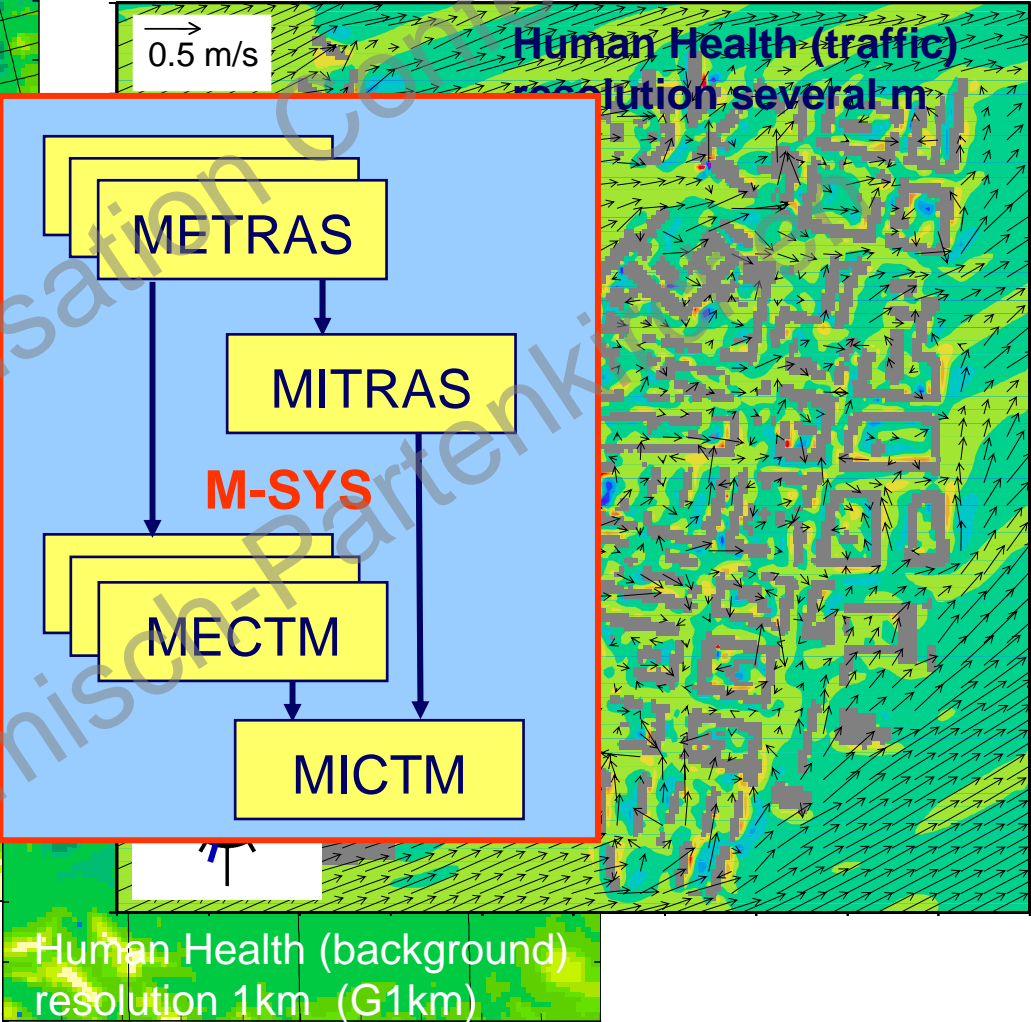
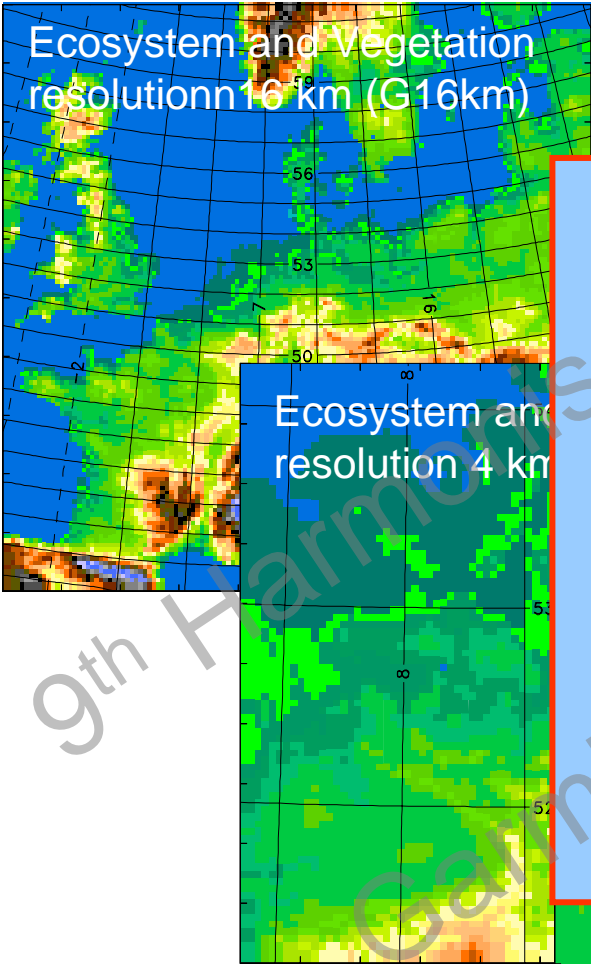
Alfred Trukenmüller, David Grawe,
K. Heinke Schlünzen

- Outline of model system
- Results
- Conclusions

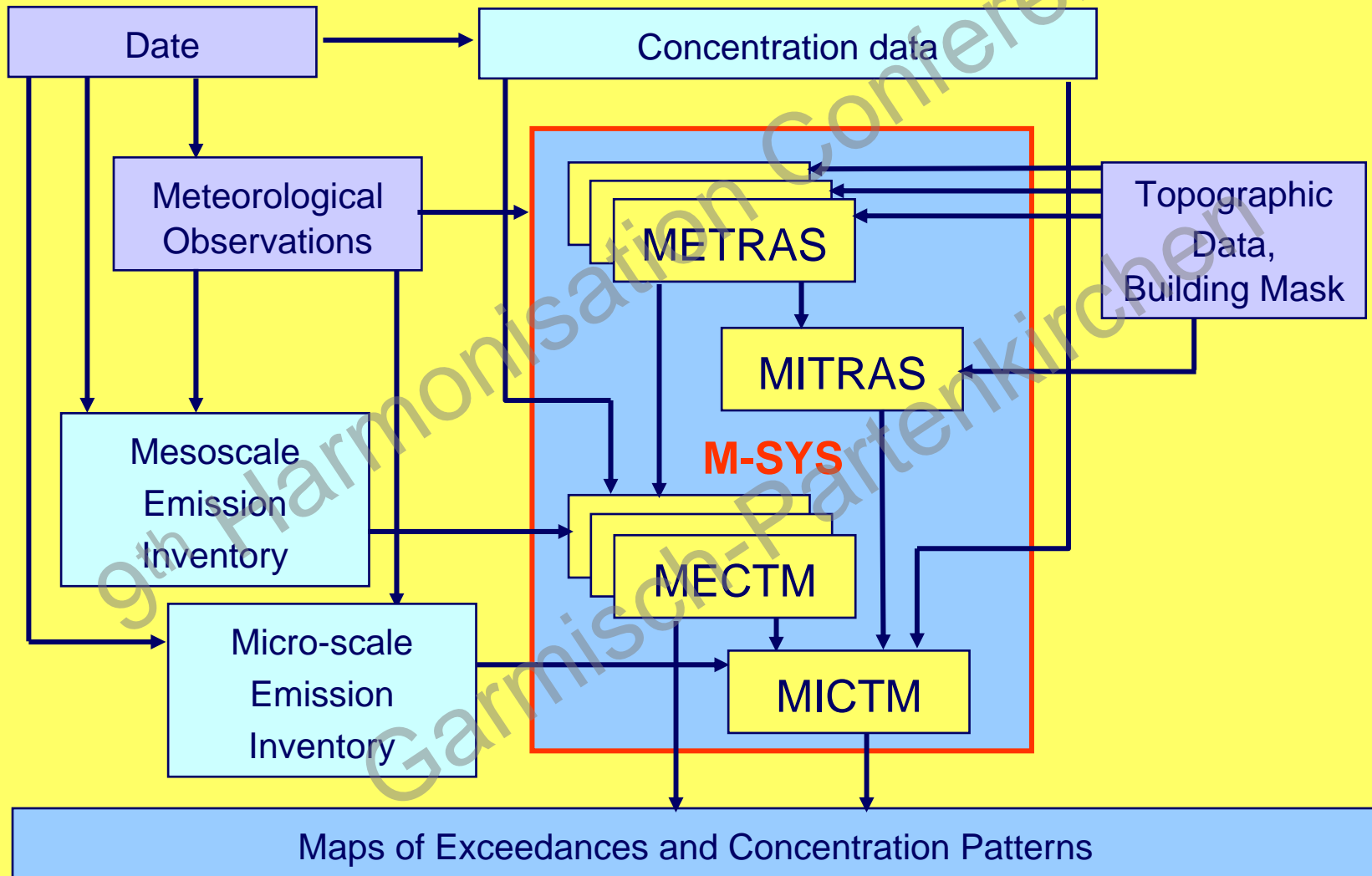
Requirements based on directives - area coverage information -

- **Ecosystem and vegetation**
Concentration representative for
at least 1000 km² (e.g. 35x30 km²)
- **Human health (urban background sources)**
Concentration representative for
several square kilometres (e.g. 2x2 km²)
- **Human health (traffic)**
Concentration representative for
more than 200 m², e.g. 5x40 m²

Scales of M-SYS



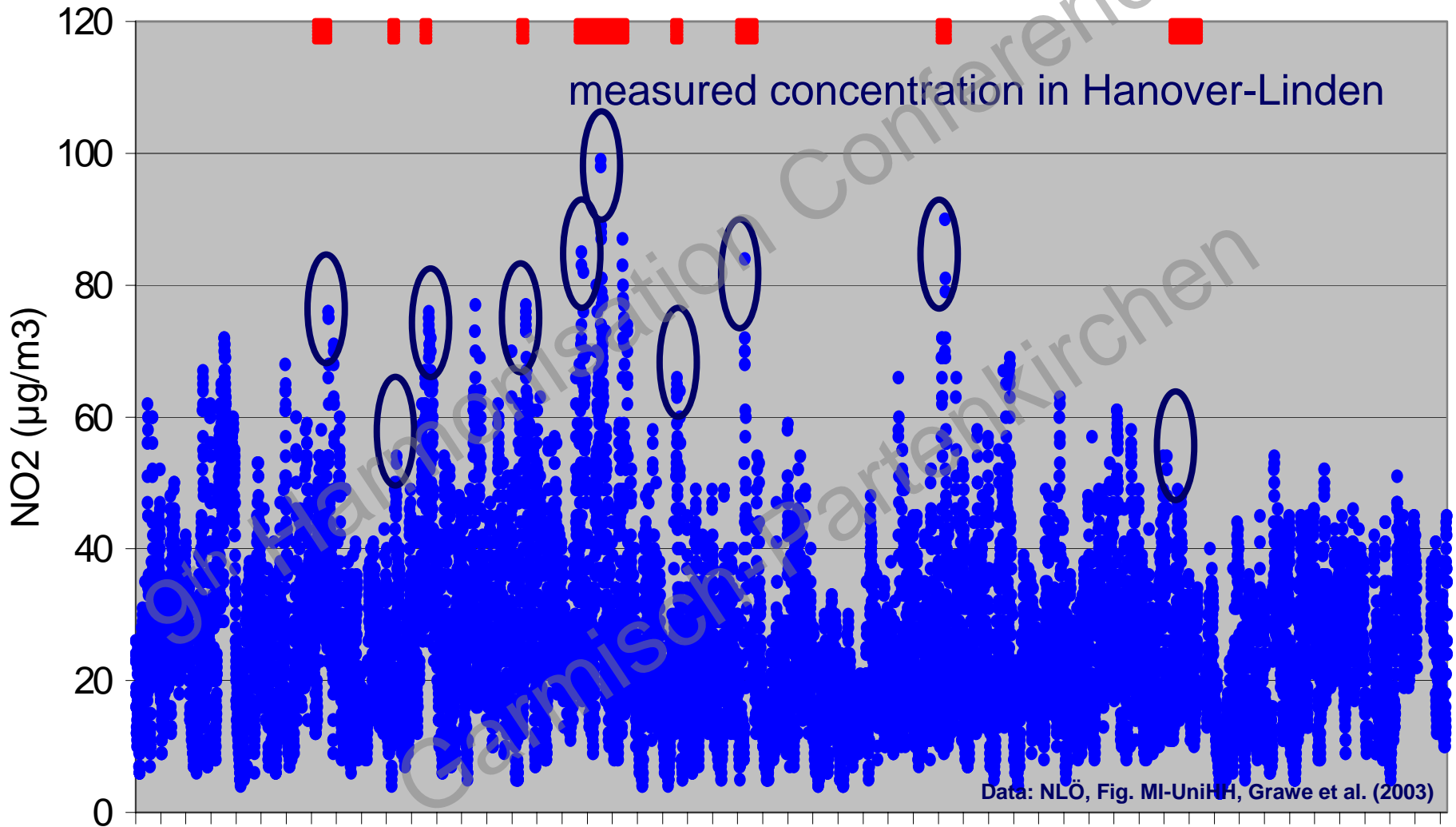
Model communication and data flow



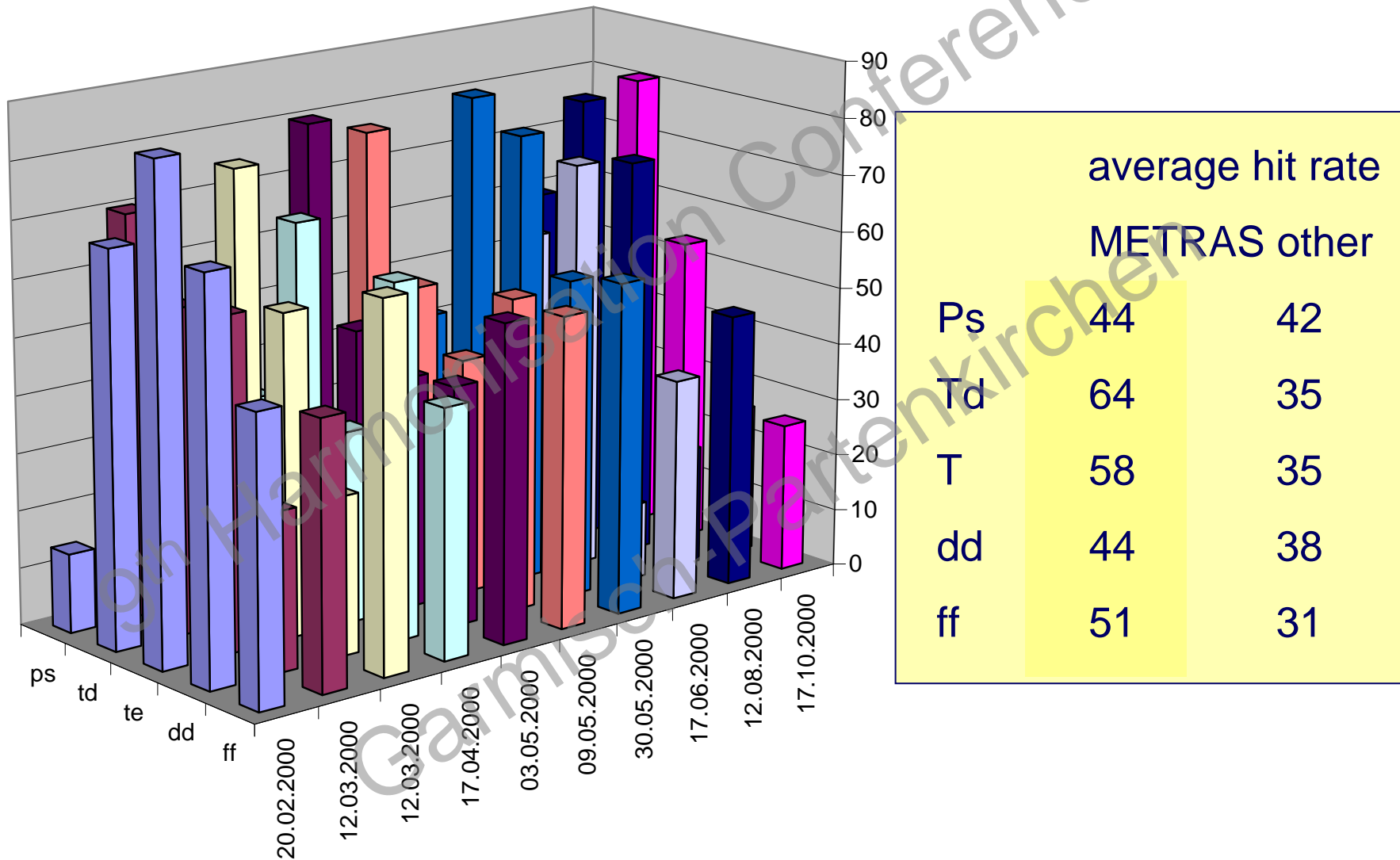
Results

9th Harmonisation Conference
Garmisch-Partenkirchen

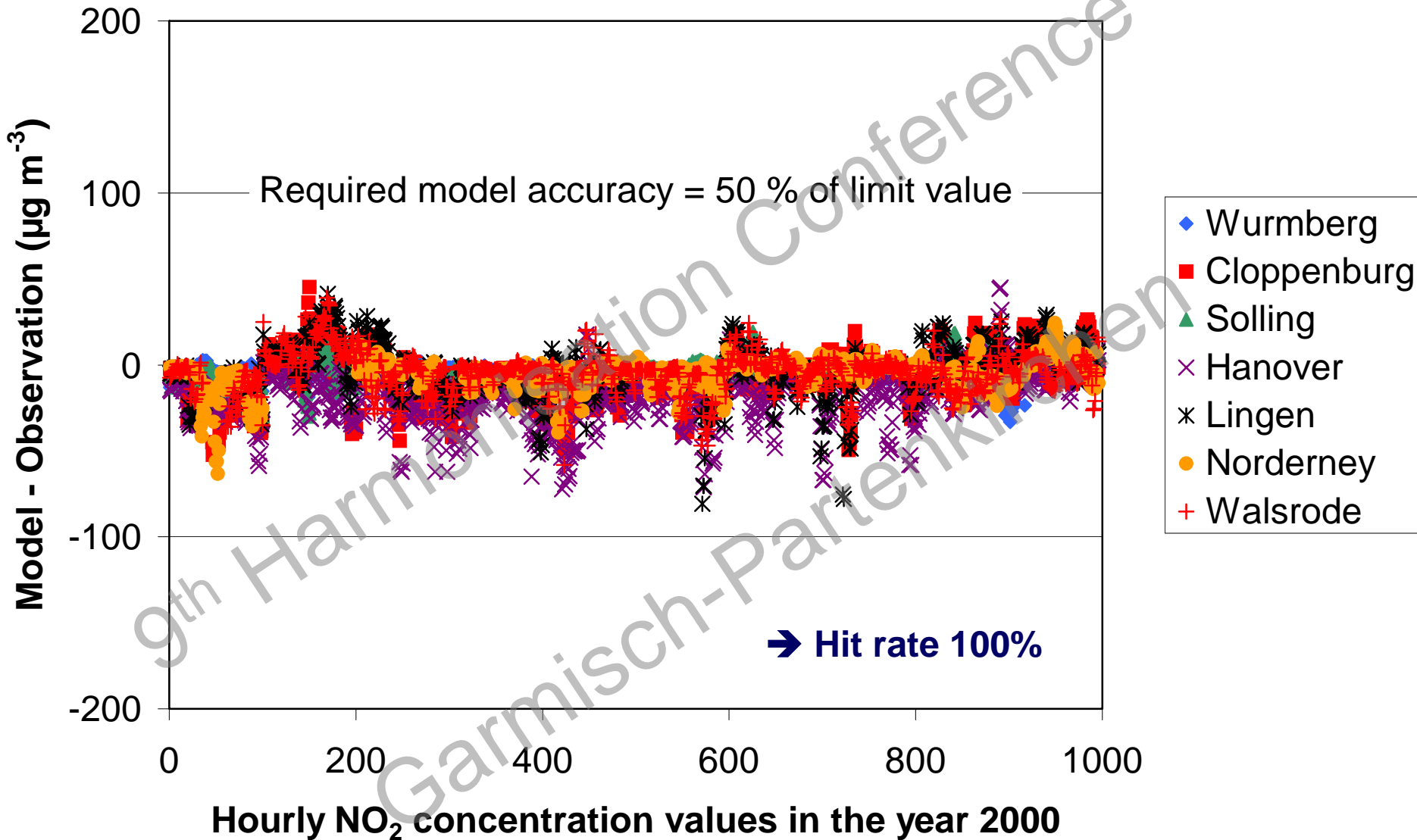
40 days in year 2000 selected for maps



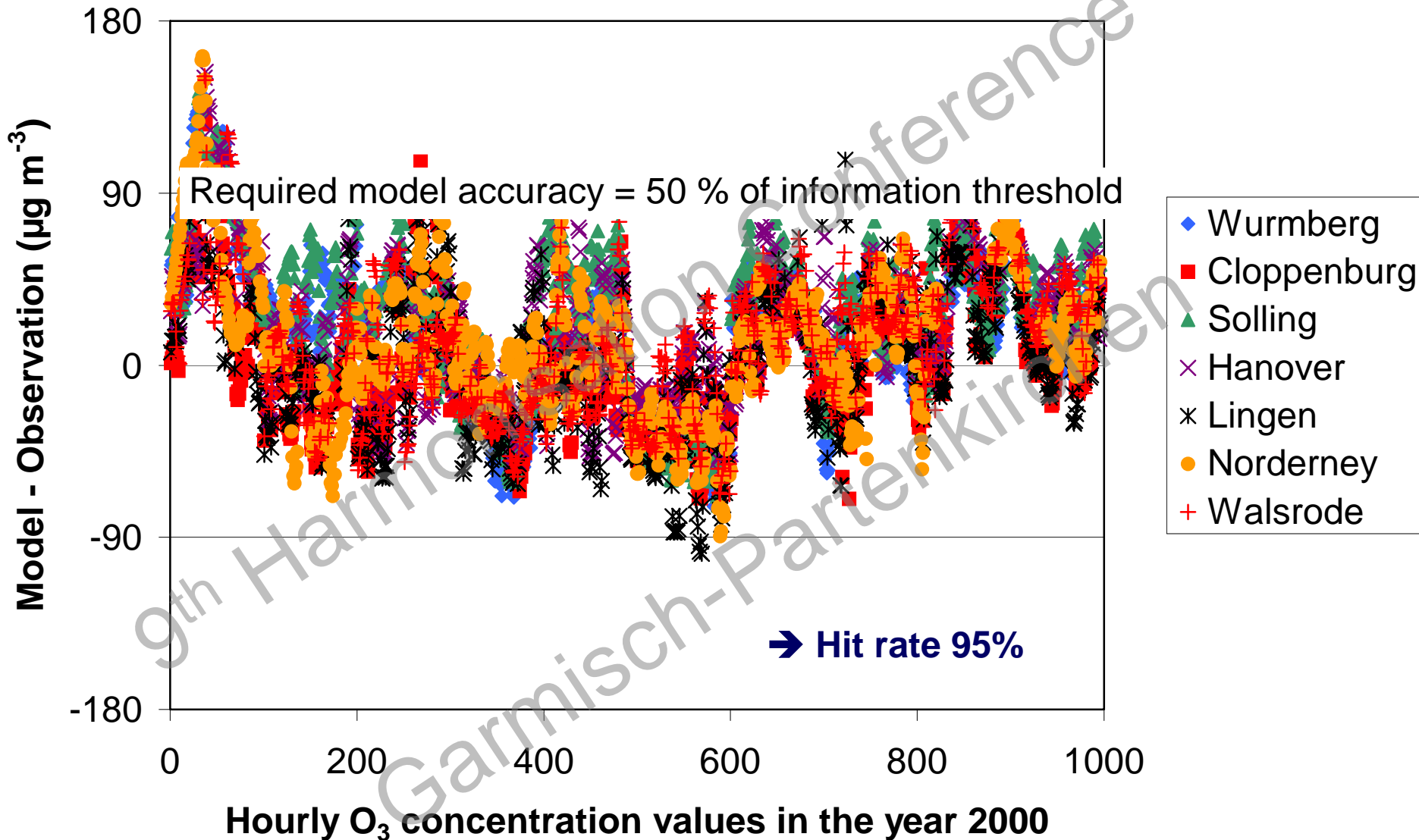
Hit rates for 10 days (area Lower Saxony, G16km)

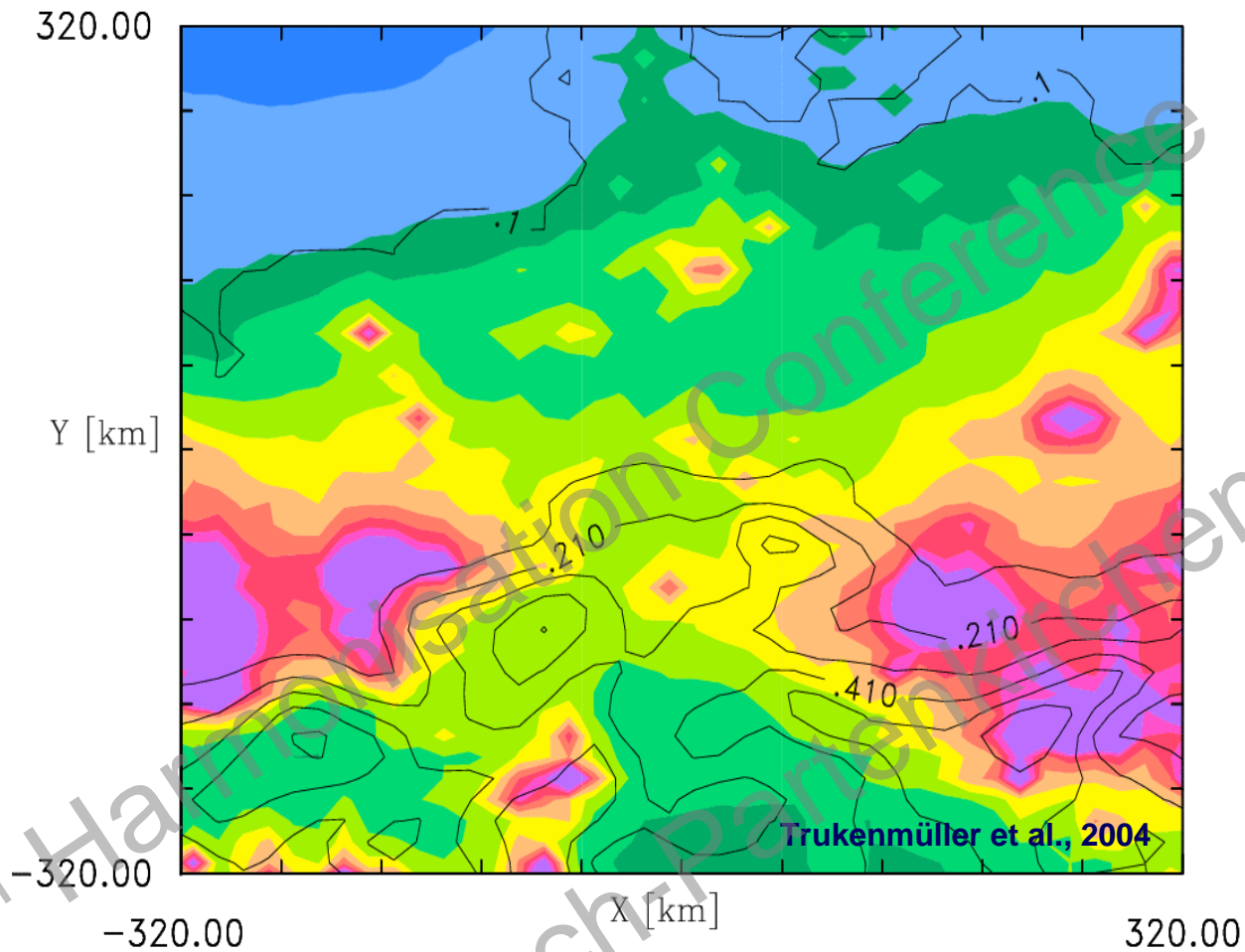


Evaluation of NO₂ concentrations (G16km)



Evaluation of O₃ concentrations (G16km)



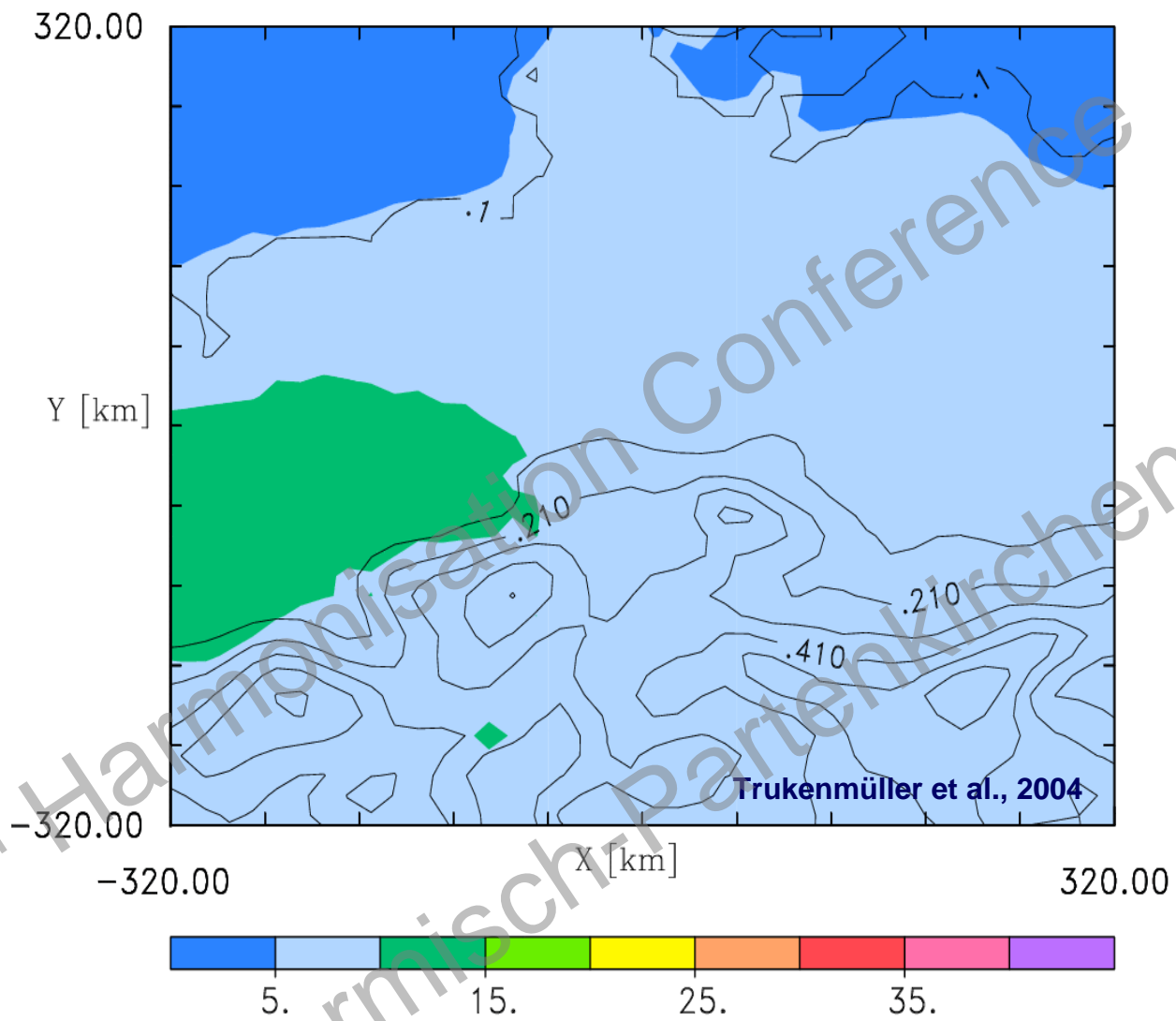


Mean concentration of **SO₂** (µg m⁻³)

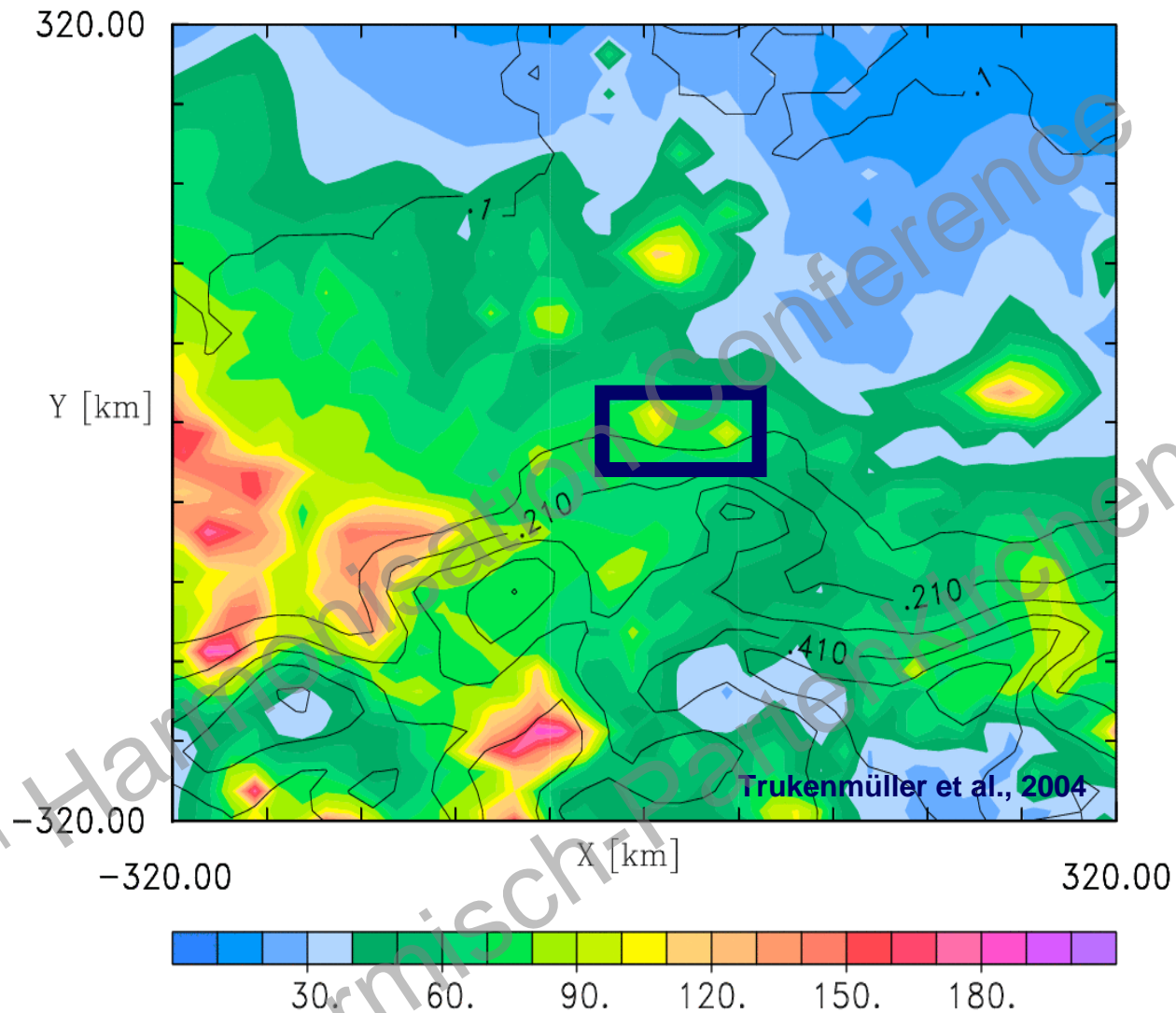
calculated from G16km simulations of Hanover high NO₂ concentration days

Annual limit value for the protection of ecosystems: 20 µg m⁻³

Contour lines: altitude above sea level



Mean concentration of **nitrate plus sulphate aerosol** ($\mu\text{g m}^{-3}$)
 calculated from G16km simulations of Hanover high NO_2 concentration days
 Annual limit value for the protection of human health
 (PM10) 2005: $40 \mu\text{g m}^{-3}$, 2010: $20 \mu\text{g m}^{-3}$

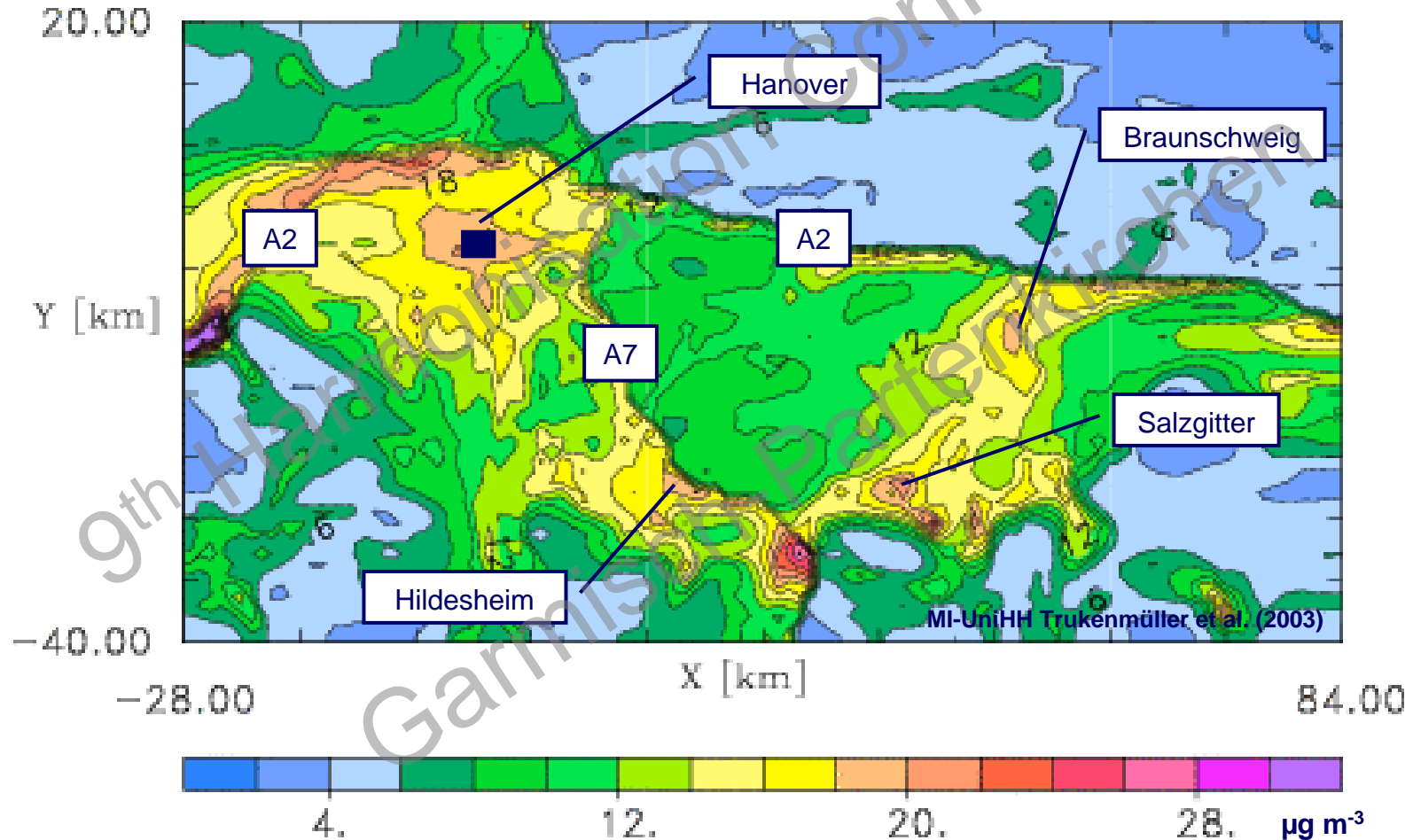


19th highest hourly mean concentration of **NO₂ (µg m⁻³)** based on G16km simulation
 Hourly limit value for the protection of human health: 200 µg m⁻³
 Contour lines: altitude above sea level

Urban Scale

NO₂ 10 m above Ground, 9.5.2000 8 a.m.

1 km resolution

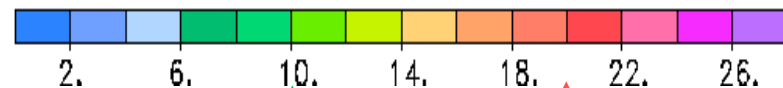
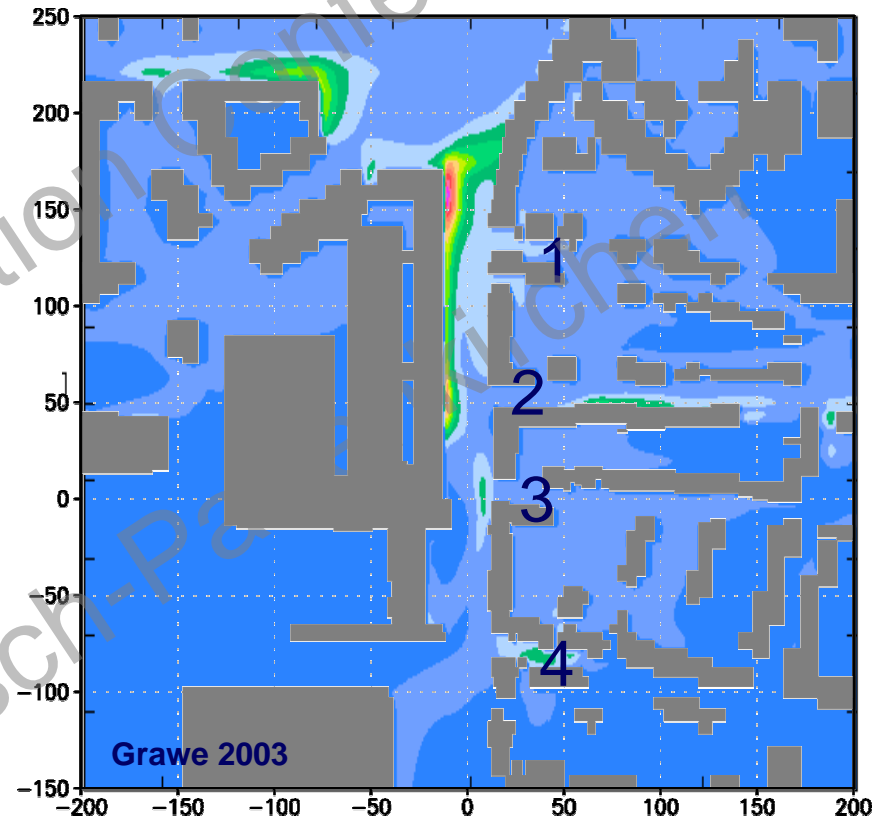
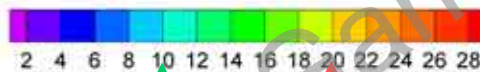
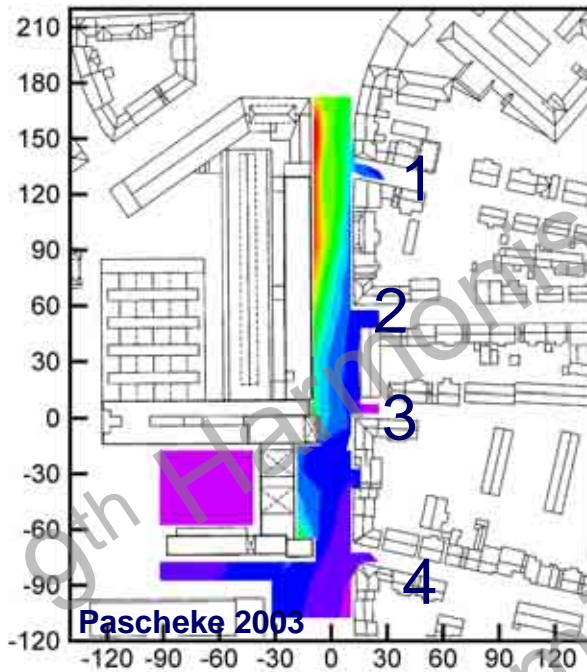


Comparison MICTM with wind tunnel data

C^* (NO_x)

DD = 220°

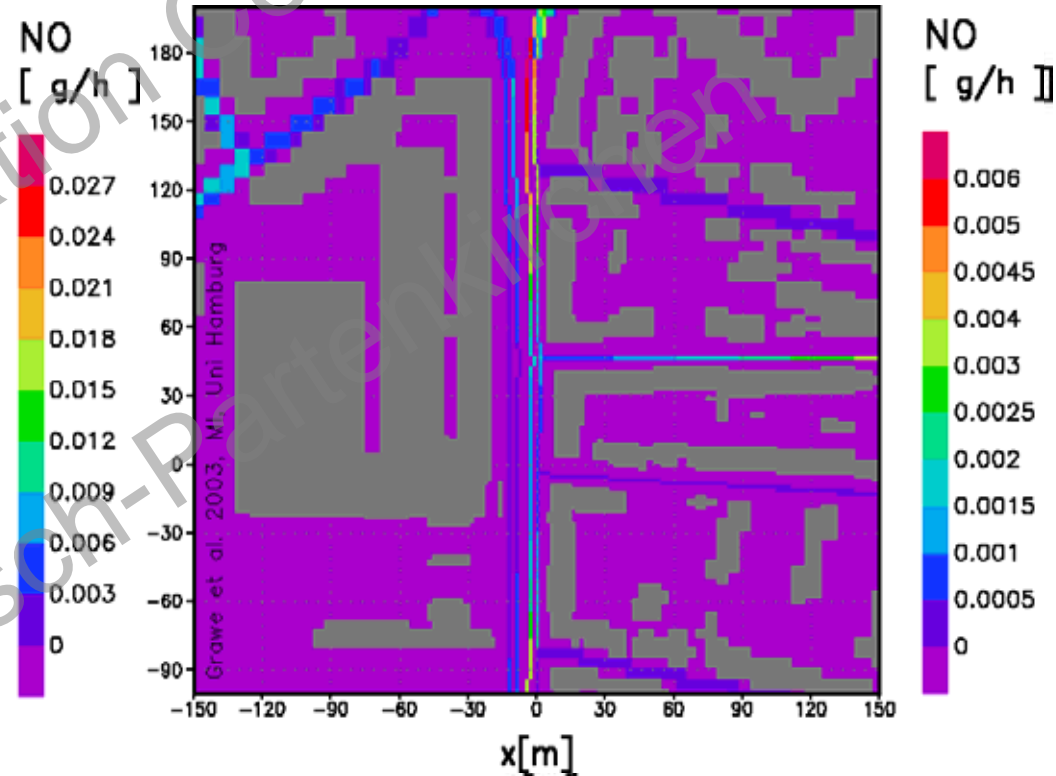
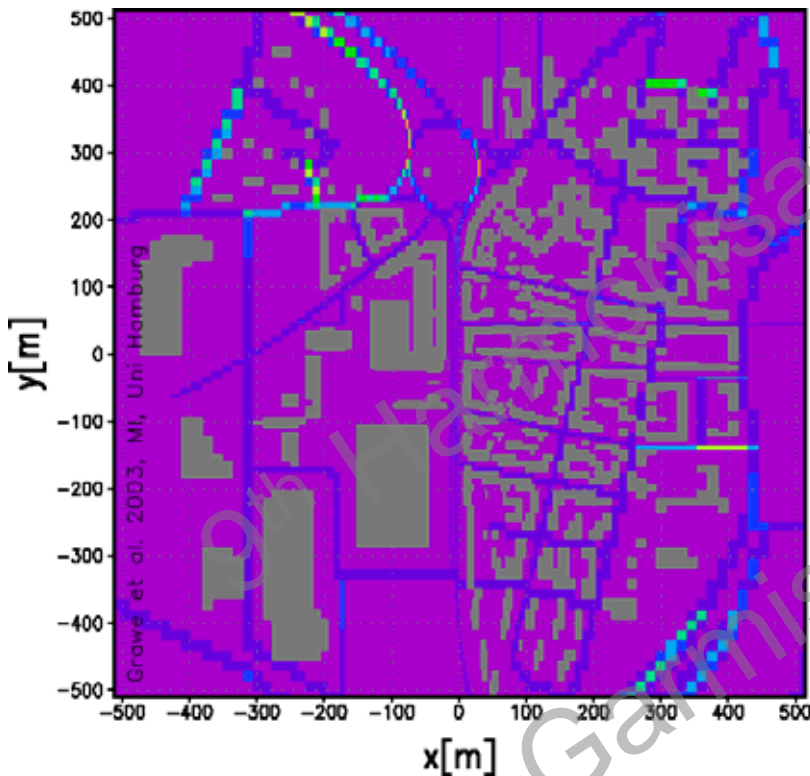
z = 9.8 m



Traffic emission data in MICTM (emission data from IER Stuttgart)

full model area

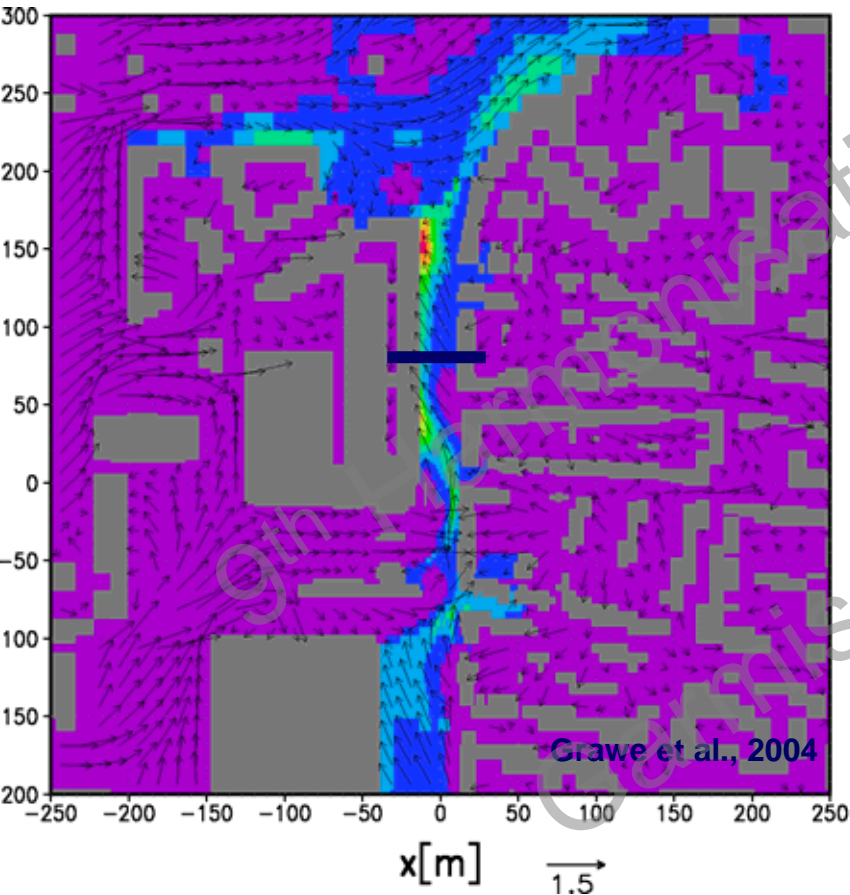
central part of model area



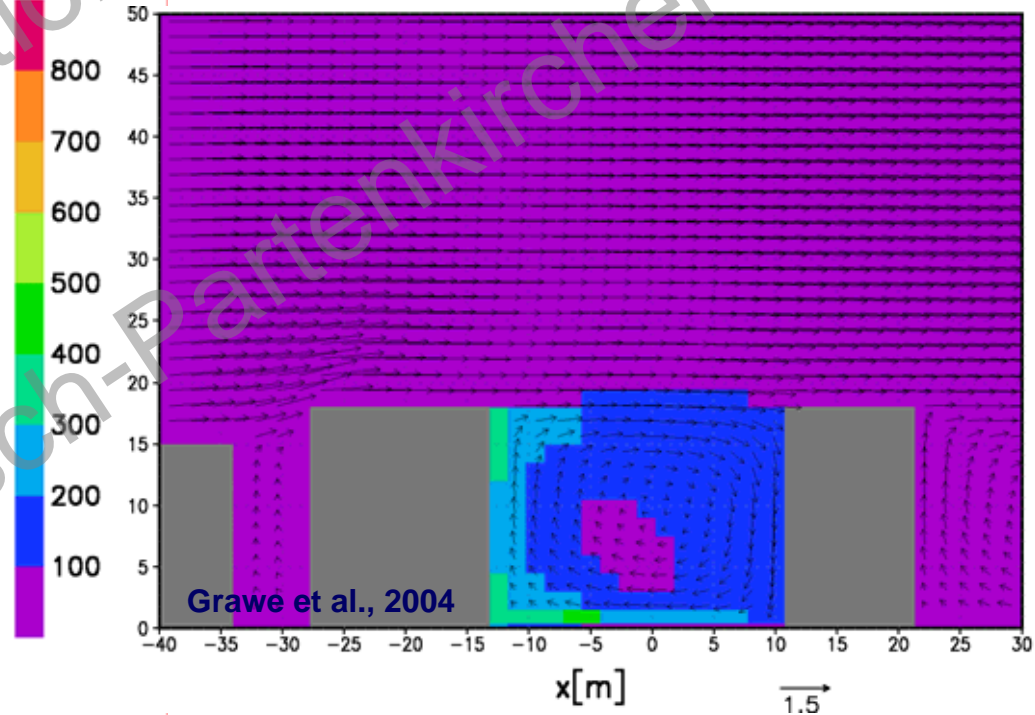
Emission per grid cell for 11.4.2003, 07:00-08:00

NO concentrationen for 11th April, 2003, 07:00-07:30

Horizontal cross section at $z=1,5$ m

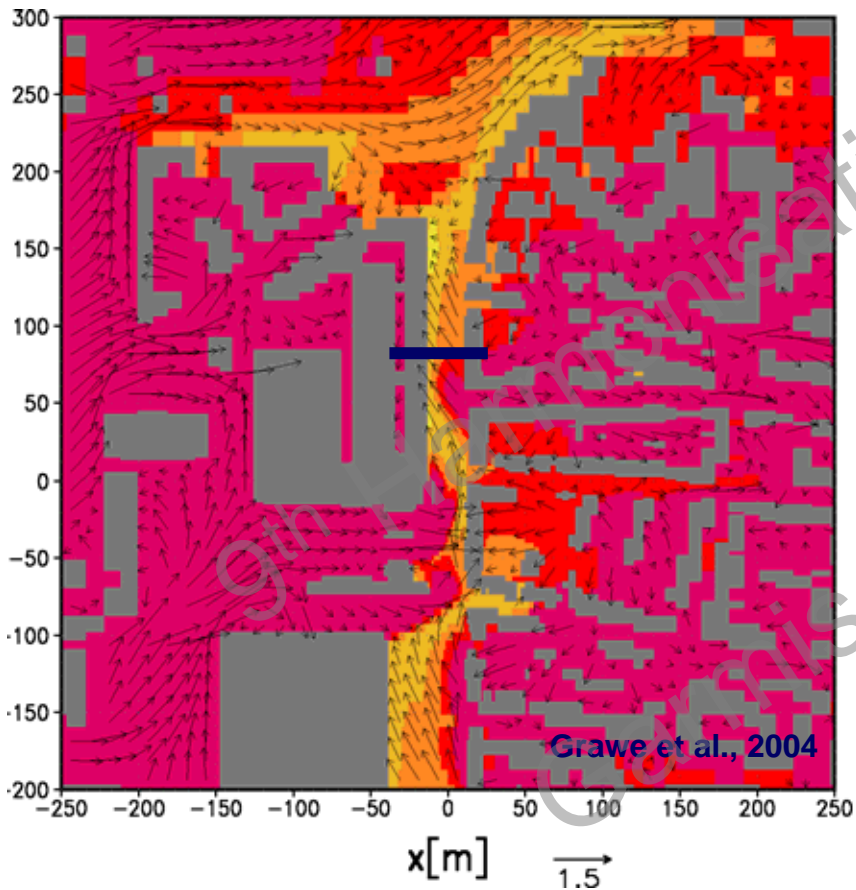


Vertical cross section
(bar in left figure)

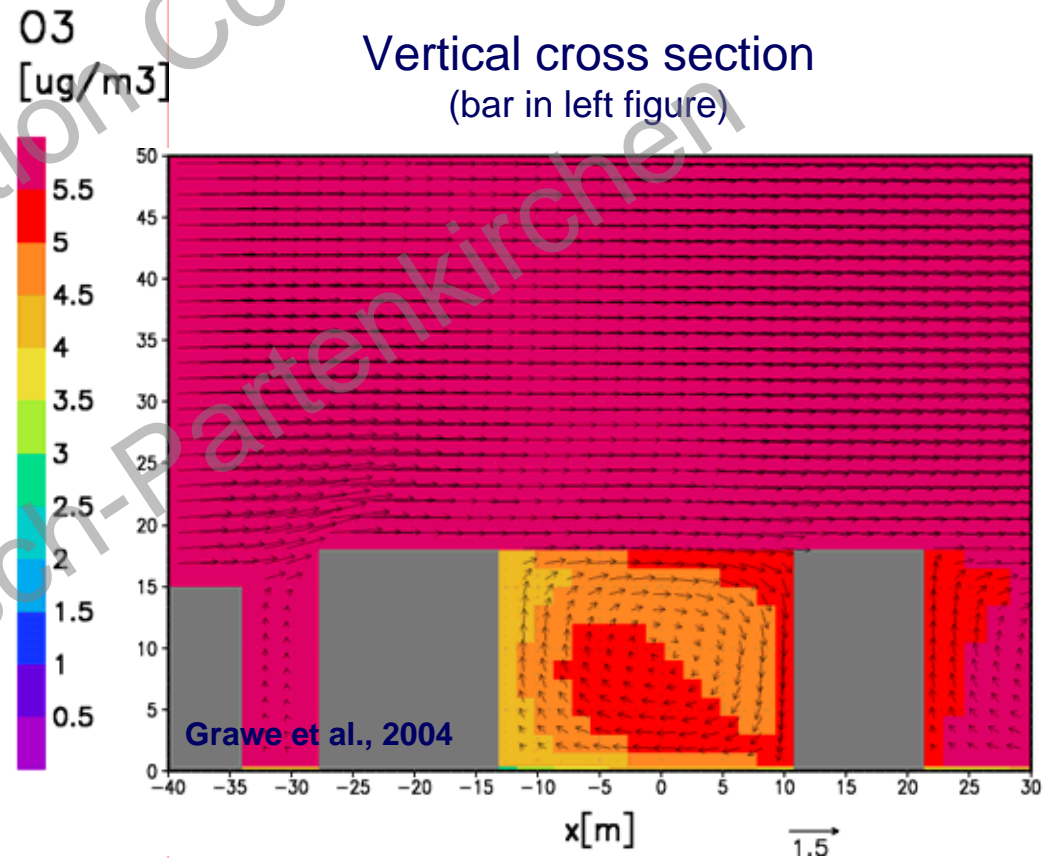


O₃ concentrationen for 11th April, 2003, 07:00-07:30

Horizontal cross section at z=1,5 m

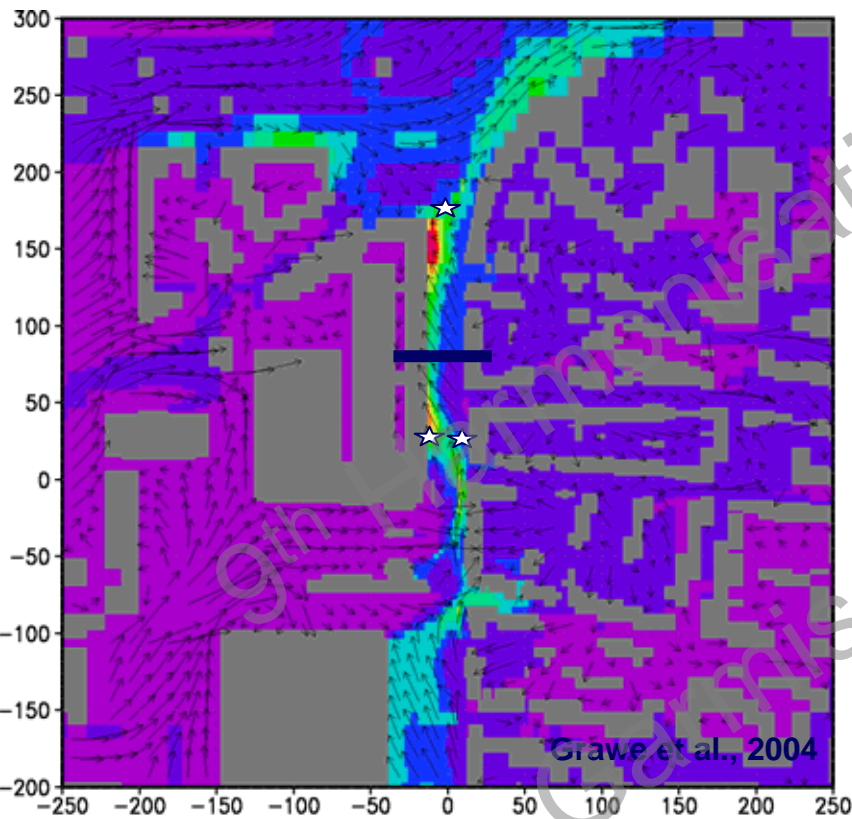


Vertical cross section
(bar in left figure)

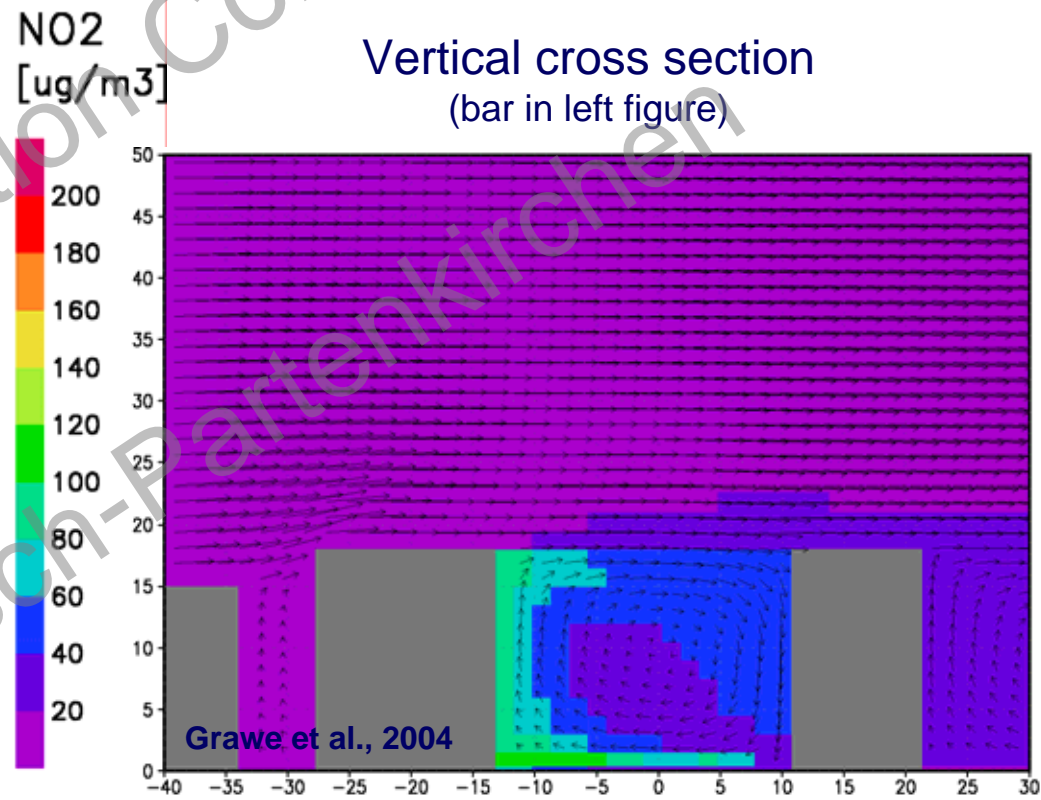


NO₂ concentrationen for 11th April, 2003, 07:00-07:30

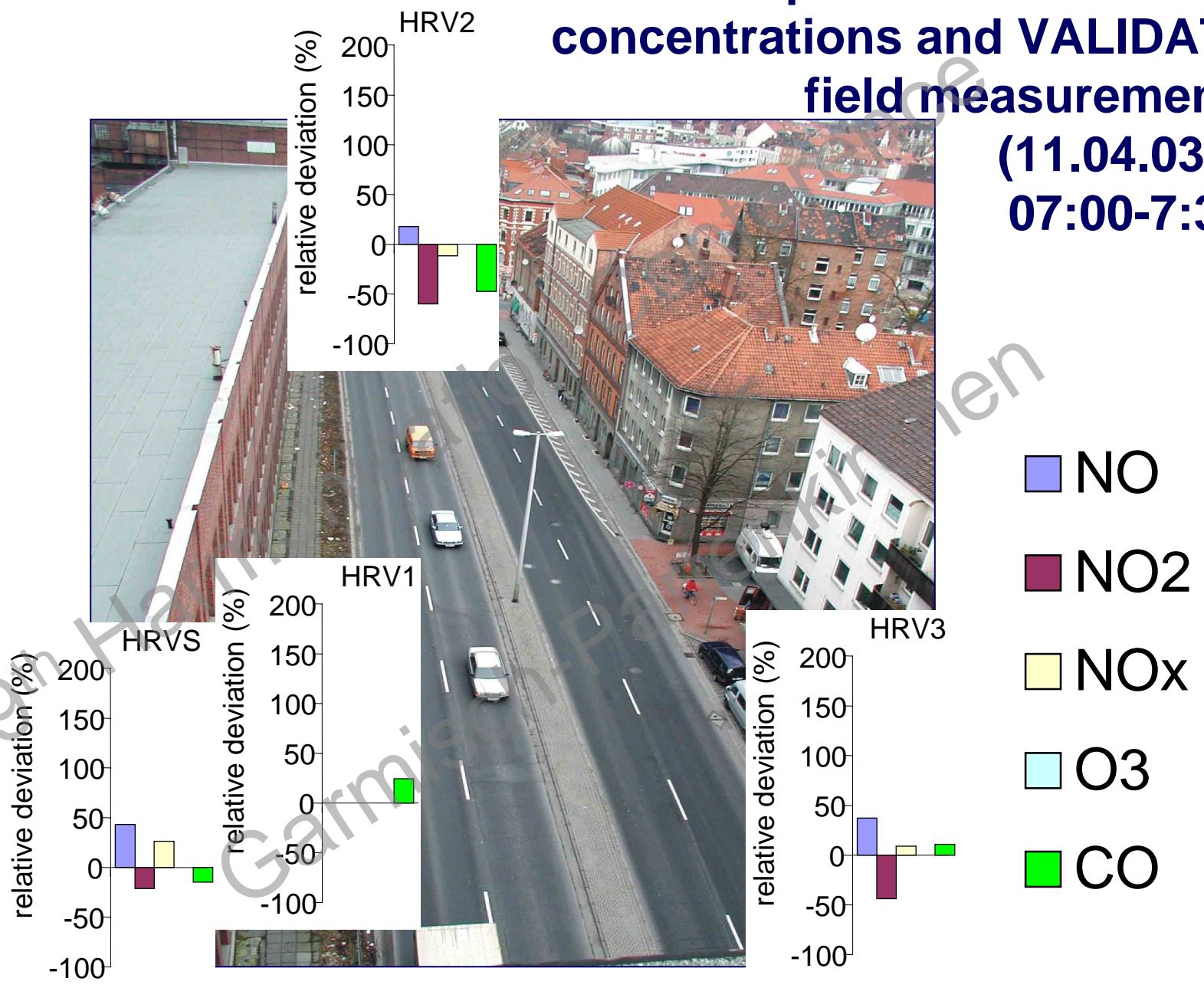
Horizontal cross section at z=1,5 m



Vertical cross section
(bar in left figure)



Comparison of simulated concentrations and VALIDATA field measurements (11.04.03, 07:00-7:30)



Conclusions

- Results of nested meso- and micro-scale meteorology models (METRAS and MITRAS) agree well with meteorological routine (and wind tunnel) data.
- Results of nested meso- and micro-scale CTMs (MECTM and MICTM) agree well with routine, wind tunnel and field concentration data.
- M-SYS G16km NO₂ results fulfil the quality required by EU directives. For calculating the human health protection values resolutions 4km and 1km are essential.
- To fulfil current EU objectives for aerosols in 2010, reductions of the precursors (NO_x, NH₃) are essential.

Next steps

- With M-SYS a research prototype was successfully developed. M-SYS needs now to be optimised with respect to computer and human resources.
 - The selected days need to be simulated on G4km and G1km as well as on the microscale.
 - Maps on all different scales have to be derived.
- Application for further funding.

Acknowledgements

BMBF for funding research project 07ATF12,

German and British weather services for meteorology data,

The VALIUJM consortium for the past three years of great collaboration, the data (emission, concentration measurements and databank VALIDATA), intense discussions, critical questions, challenging tasks, ...

Thank you for your attention!