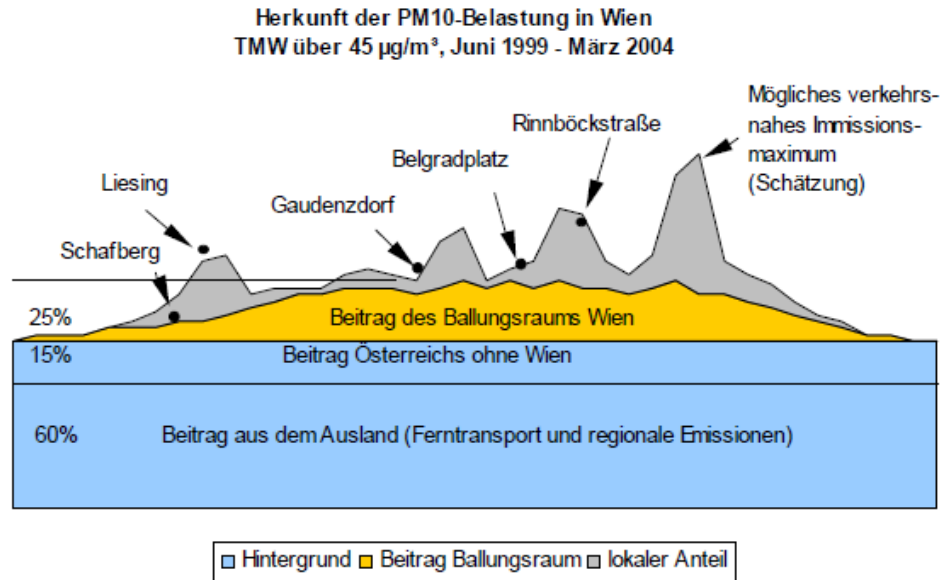# Regional air quality modelling and importance of emission data

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Why do we need regional simulations?

Herkunft der PM10-Belastung in Wien
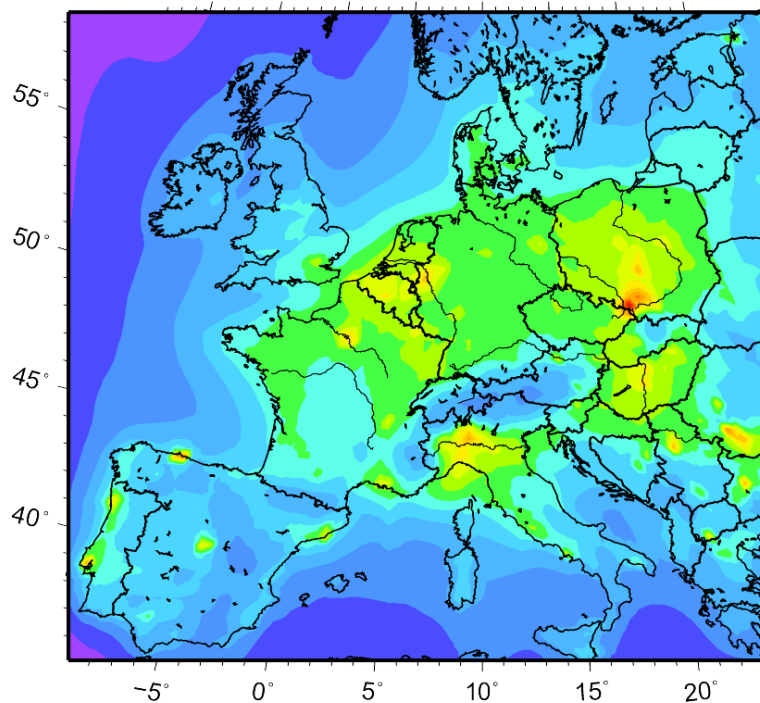TMW über 45 µg/m³, Juni 1999 - März 2004

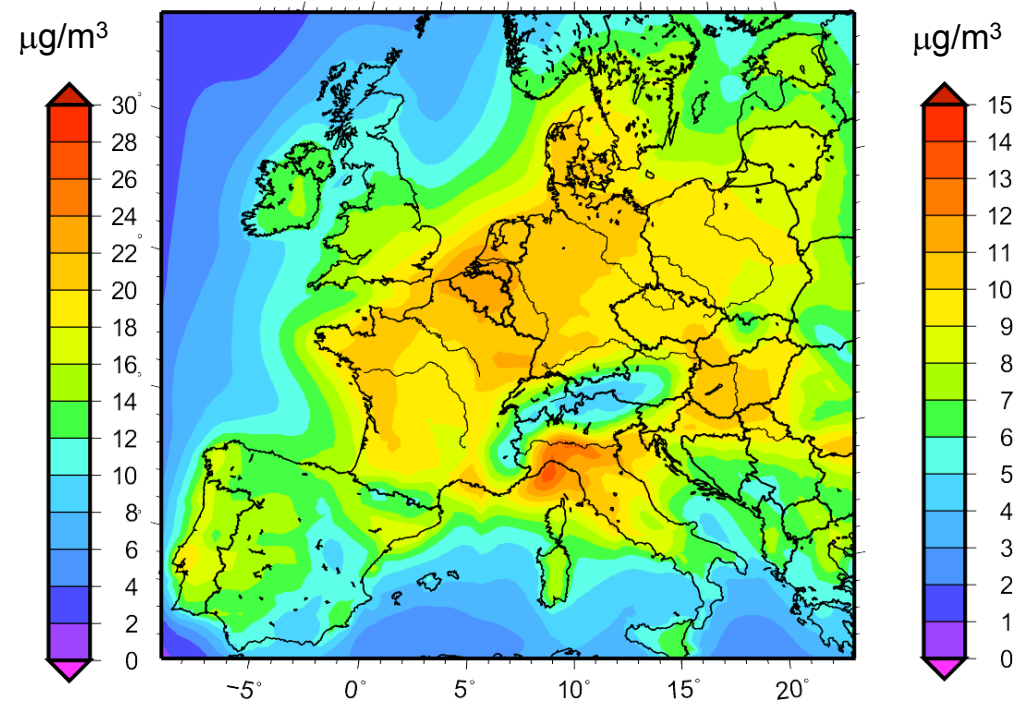Spangl et al. (im Auftrag der Auftrag des Amtes der Wiener Landesregierung, MA 22)

- Effect of regional transport
- Determination of the regional background pollution
- Formation of secondary pollutants (ozone, secondary aerosol)
- Driver for small scale simulations

Contribution of secondary aerosol
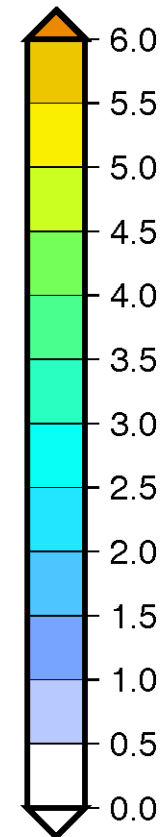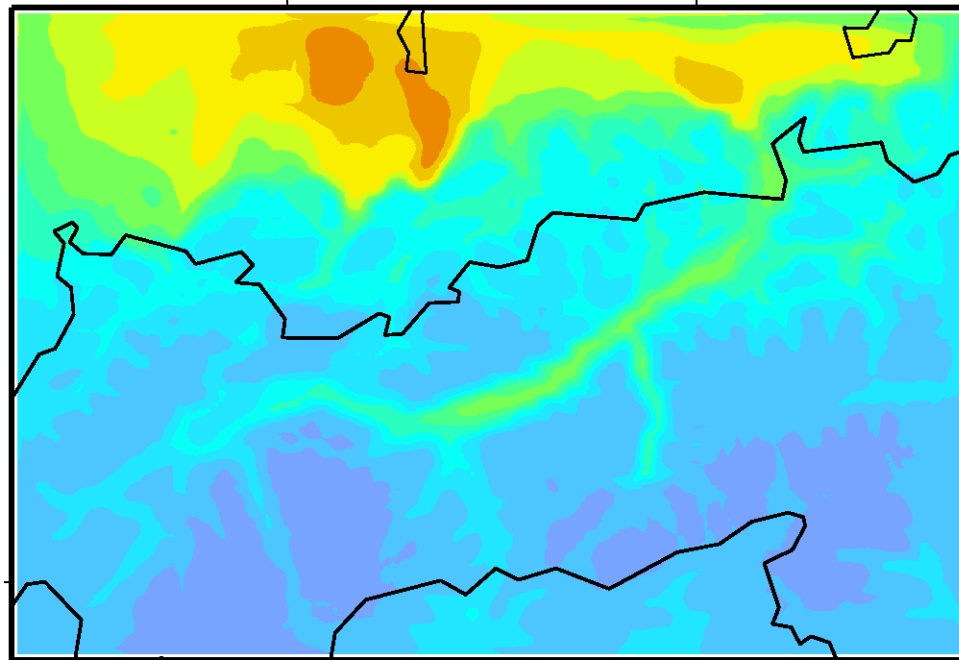

Monthly mean PM 2.5

Monthly mean secondary PM 2.5
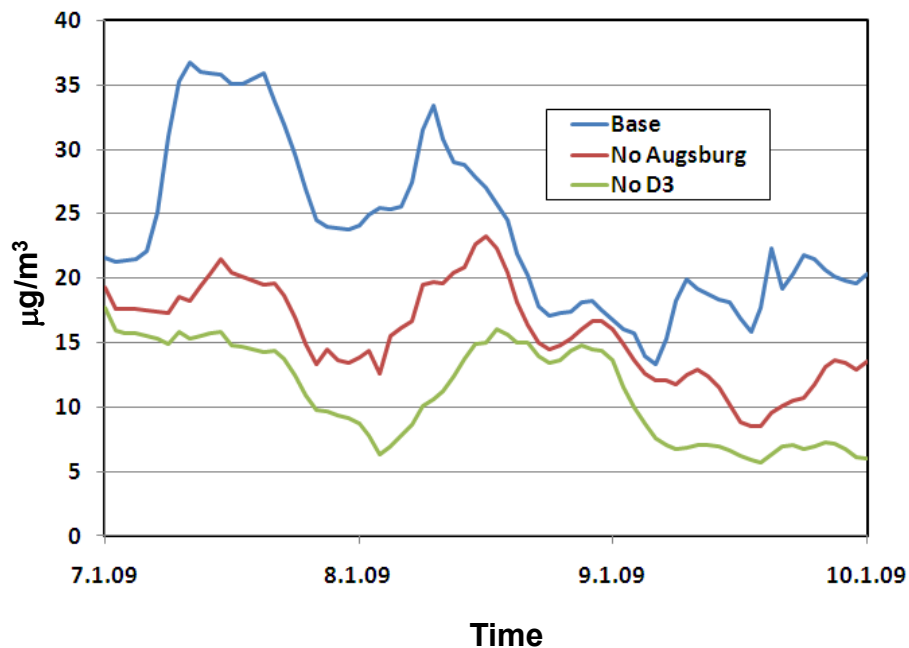
Contribution of secondary aerosol

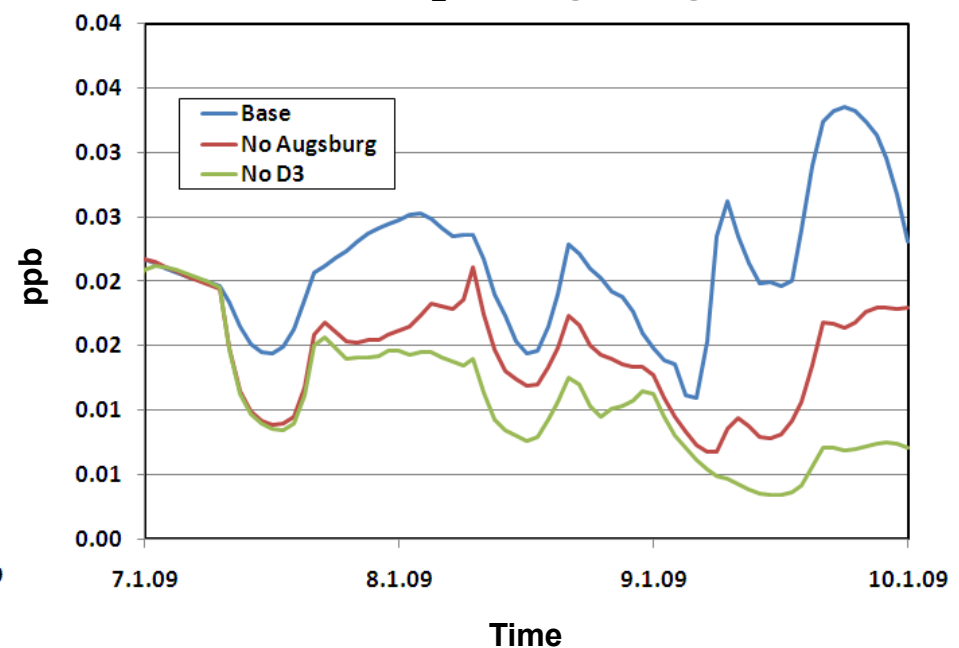Mean inorg PM2.5 (μg/m^3)
Januar 2006

Nonlocal contribution

- Three nested domains (resolution 36 km, 9 km, 2.25 km), D3 centered around Augsburg, Southern Germany
- No Augsburg: No emissions for 50 km x 50 km area around Augsburg
- No D3: No emissions for entire D3 (267 km x 186 km)

PM 2.5 at Augsburg

NO$_2$ at Augsburg

Some considerations about emissions

General problems

- Insufficient spatial resolution and coverage
- Uncertainties with respect to VOC-Split
- Insufficient coverage of sectors
- Insufficient knowledge of temporal course

Possible problems to be expected in case of different data sources
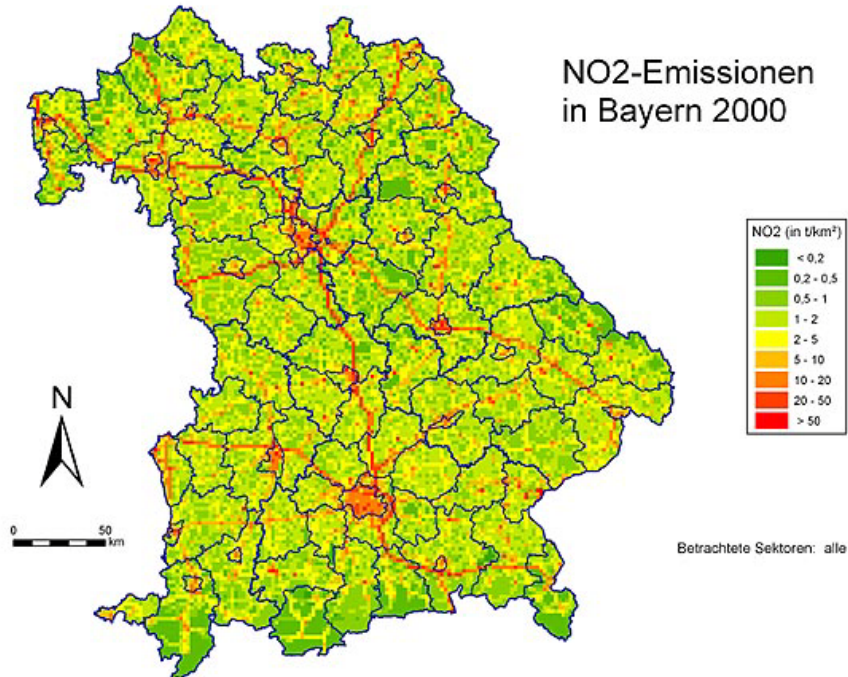
- Different definitions of sectors
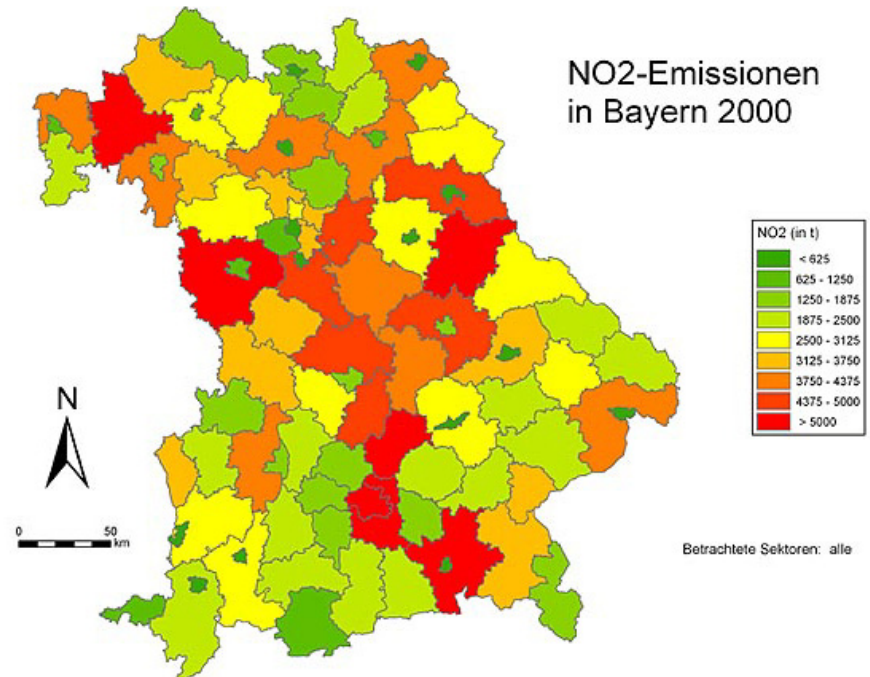- Generally inconsistent emission data
- Match at boundaries

Some examples …

Some considerations about emissions

- Spatial resolution

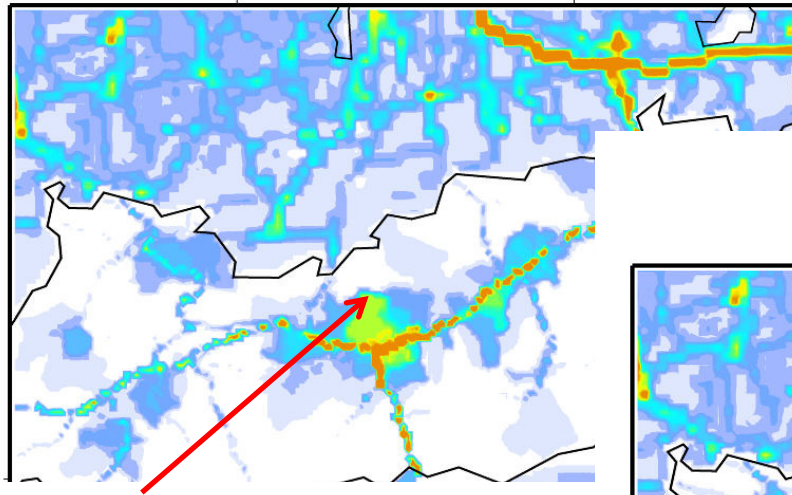What we need …   and what we sometimes get
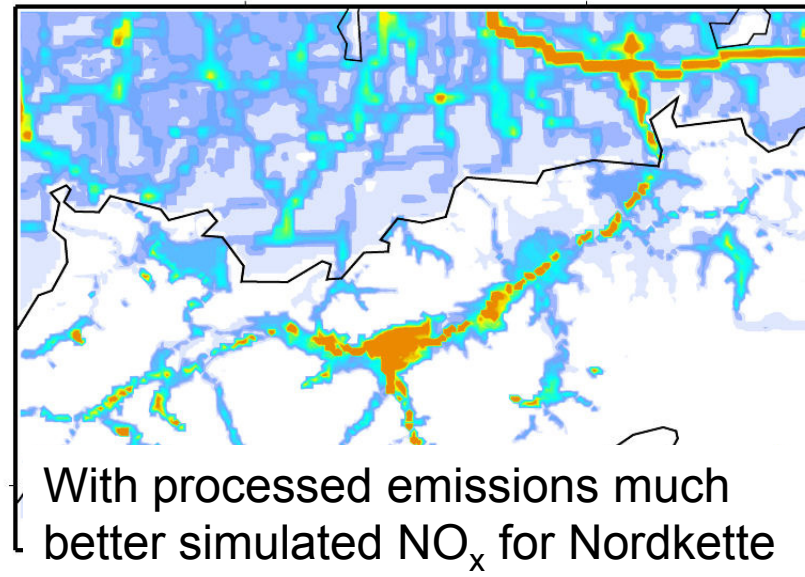
Role of spatial distribution

Area emissions were supplied for areas of the municipal territories
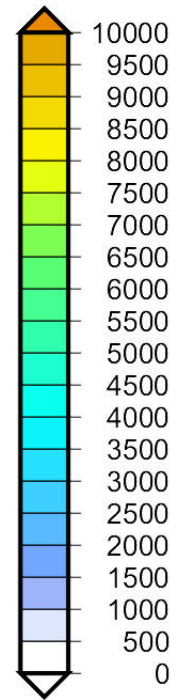
Original emissions

Processed emissions

Innsbruck Nordkette (1960m asl) is part of the municipal territory: significant NO_x emissions at 2000 asl

$\Rightarrow$ too high simulated NO_x there and too low NO_x in Innsbruck

With processed emissions much better simulated NO_x for Nordkette as well as for downtown Innsbruck

Role of VOC/NO$_x$ ratio

Example: Air quality simulations for Santiago de Chile

- D1 and D2: RETRO emissions (VOC/NO$_x$ ok)
  $\Rightarrow$ model reproduces observed ozone plume downwind of Santiago

- D3: CONAMA emissions (too low VOC/NO$_x$ ratio)
  $\Rightarrow$ model fails to simulate ozone plume downwind of Santiago
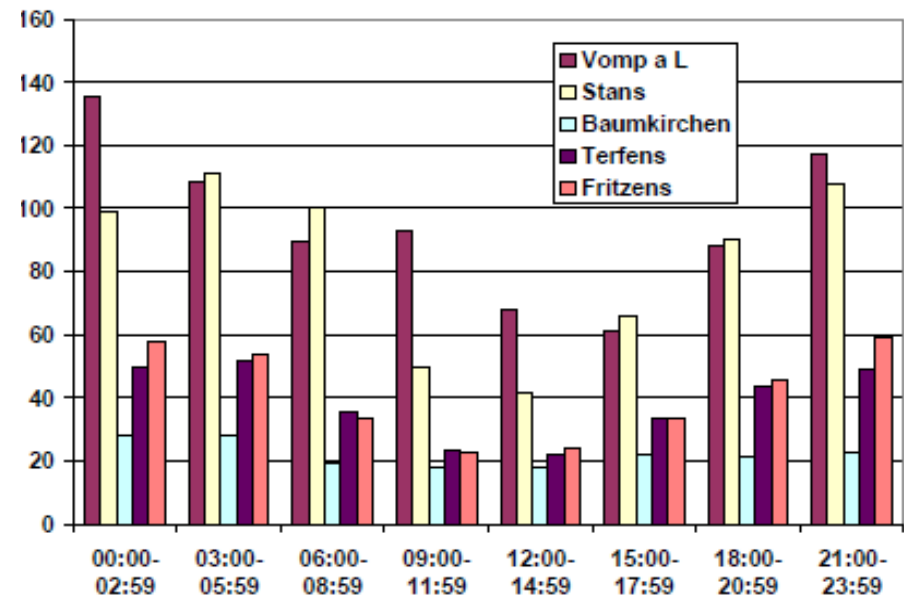

O$_3$ (ppb)

O$_3$ (ppb)
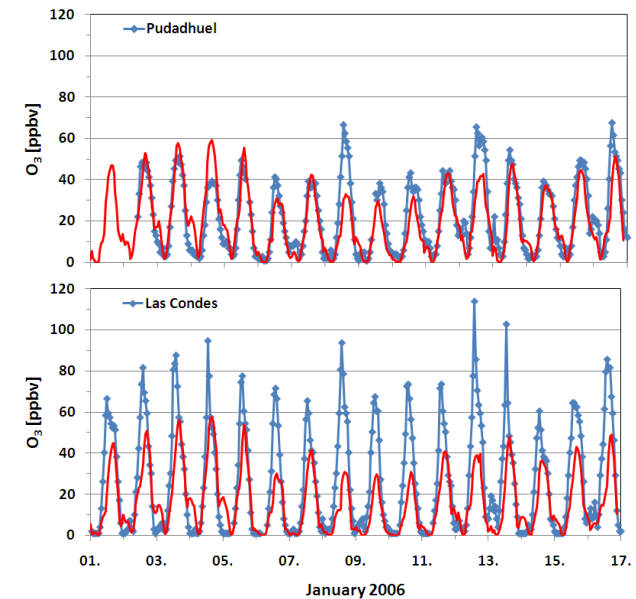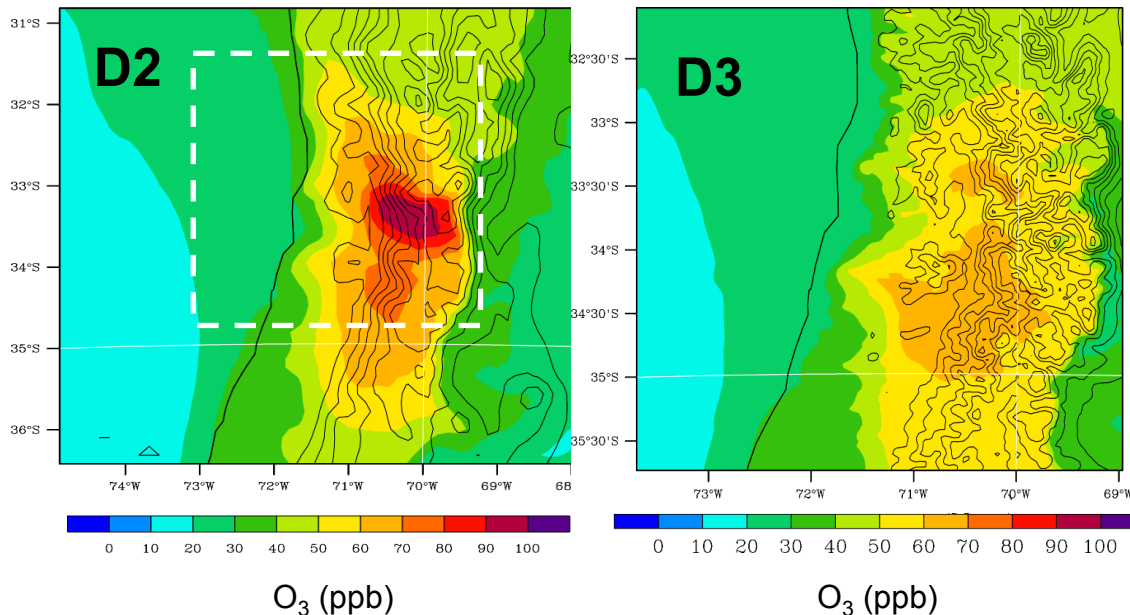
Role of diurnal course of emissions

Simulated NO_x concentation with realistic diurnal course of emissions
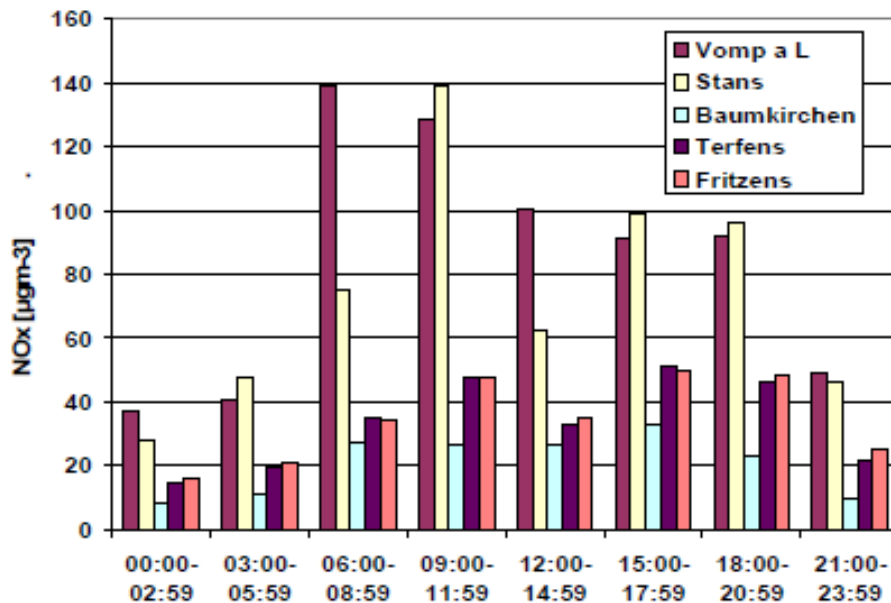
Simulated NO_x concentation with no course of emissions

Simulation with GRAL, U. Uhrner

Tasks and activities: Current status

- Supply and implementation of regridding routine for coarse grid ($\Delta x \sim 7km$) emission data ✓
- Supply and implementation of time factor routine ✓
- Support for setup of WRF/Chem with coarse scale emission data for preliminary test region ✓
- Setup of WRF/Chem for PMinter domains — Support, if necessary
- Implementation of improved time factors — If available!
- **Processing of fine scale emissions from different data sources for WRF/Chem together with TU Graz** — **Probably VERY much work**
- WRF/Chem simulations (particularly the fine scale) — Support, if necessary
- Coupling of regional and urban model — PhD-Thesis of Martin Steiner (support, if necessary)