A comparison of modal and sectional approach in aerosol modeling in the Milan area

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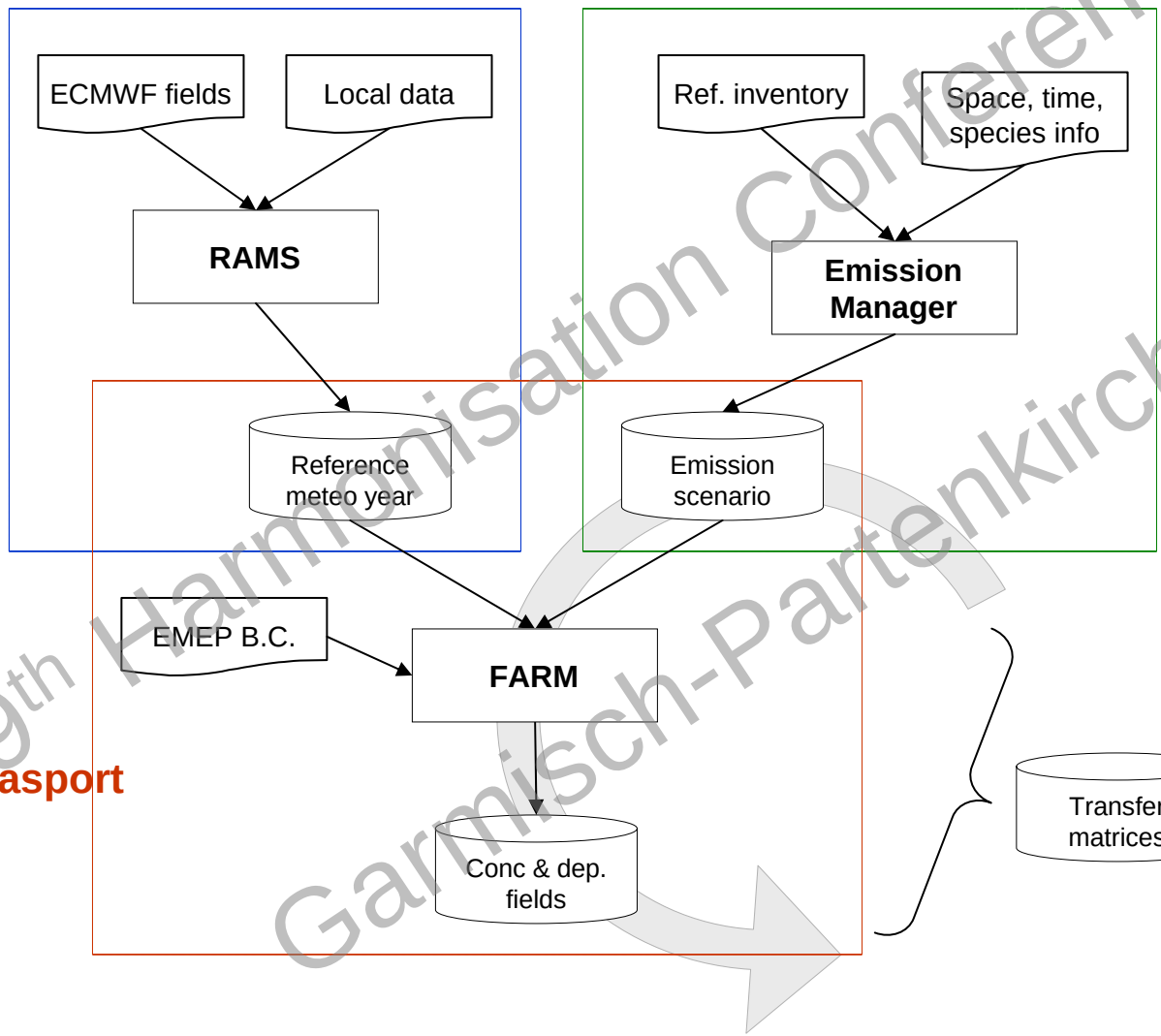
The MINNI project

Meteo
sub-system

Emission
sub-system

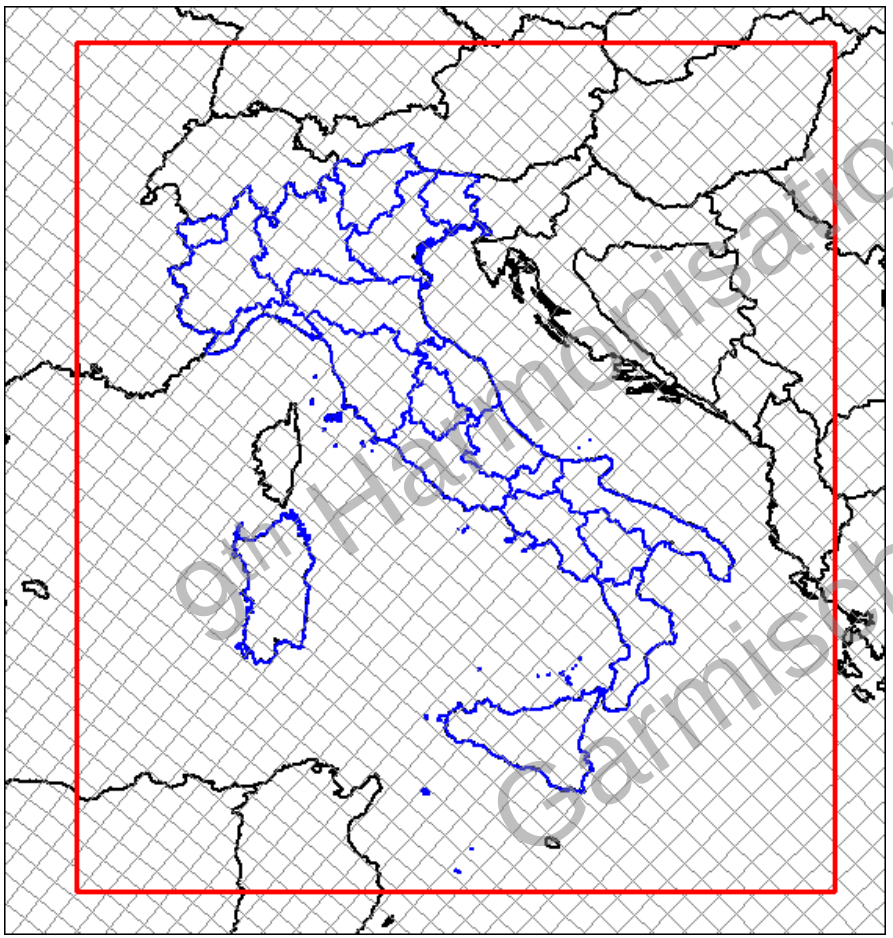


Chemical-trasport
sub-system

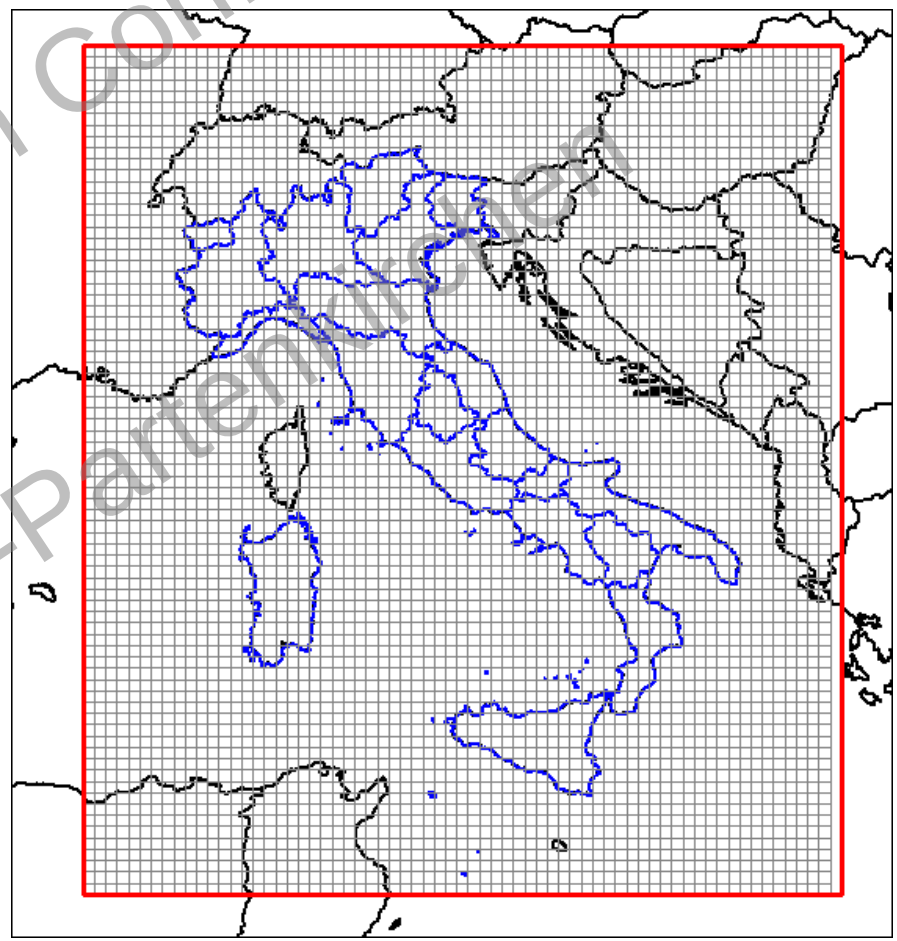
The MINNI project

Grid systems

EMEP 50 km



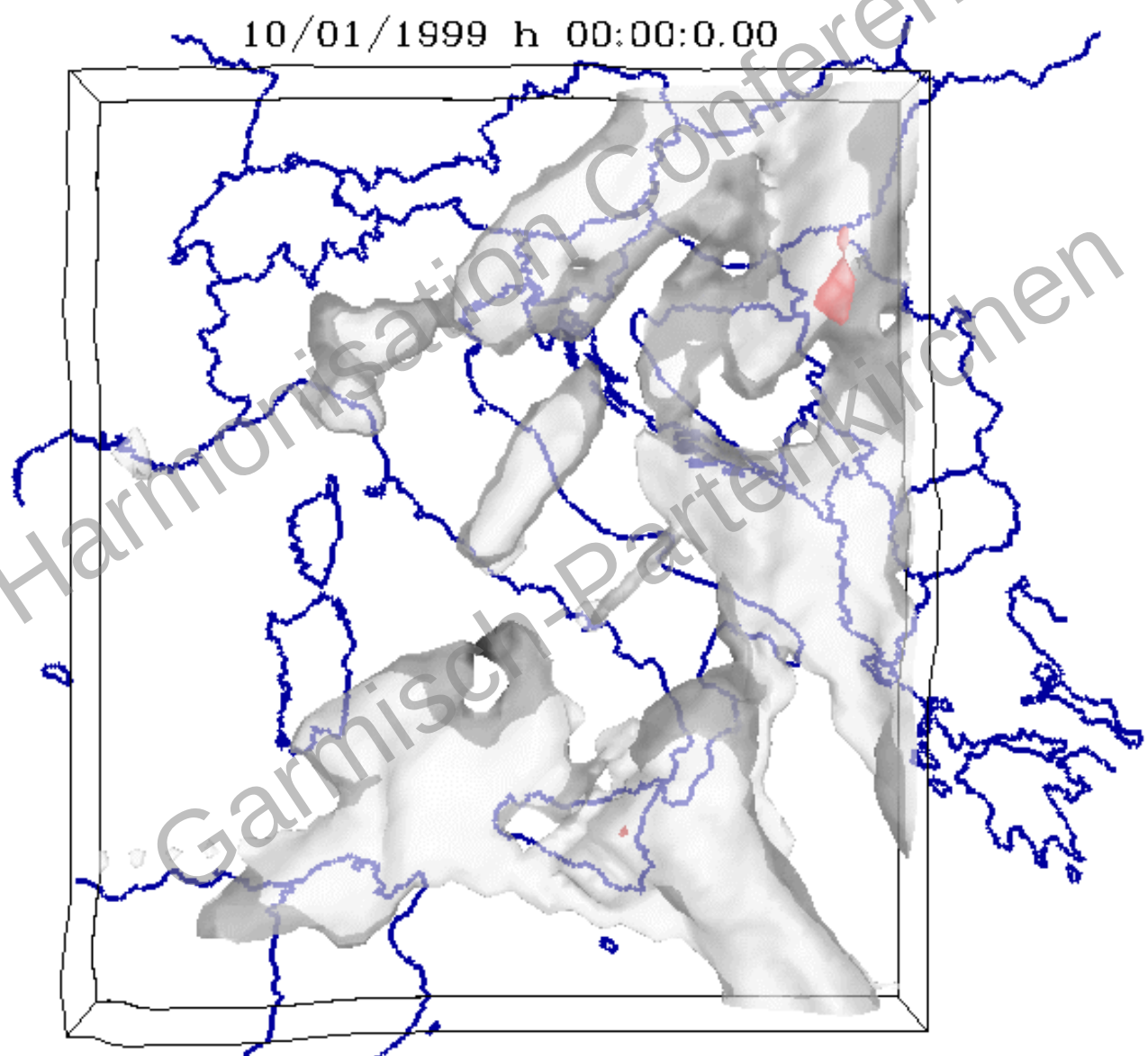
MINNI 20 km



Example of FARM model output:

SO_2 concentrations on 1-2 Oct 1999, 20 km res.

1 and 10 ppb isosurfaces

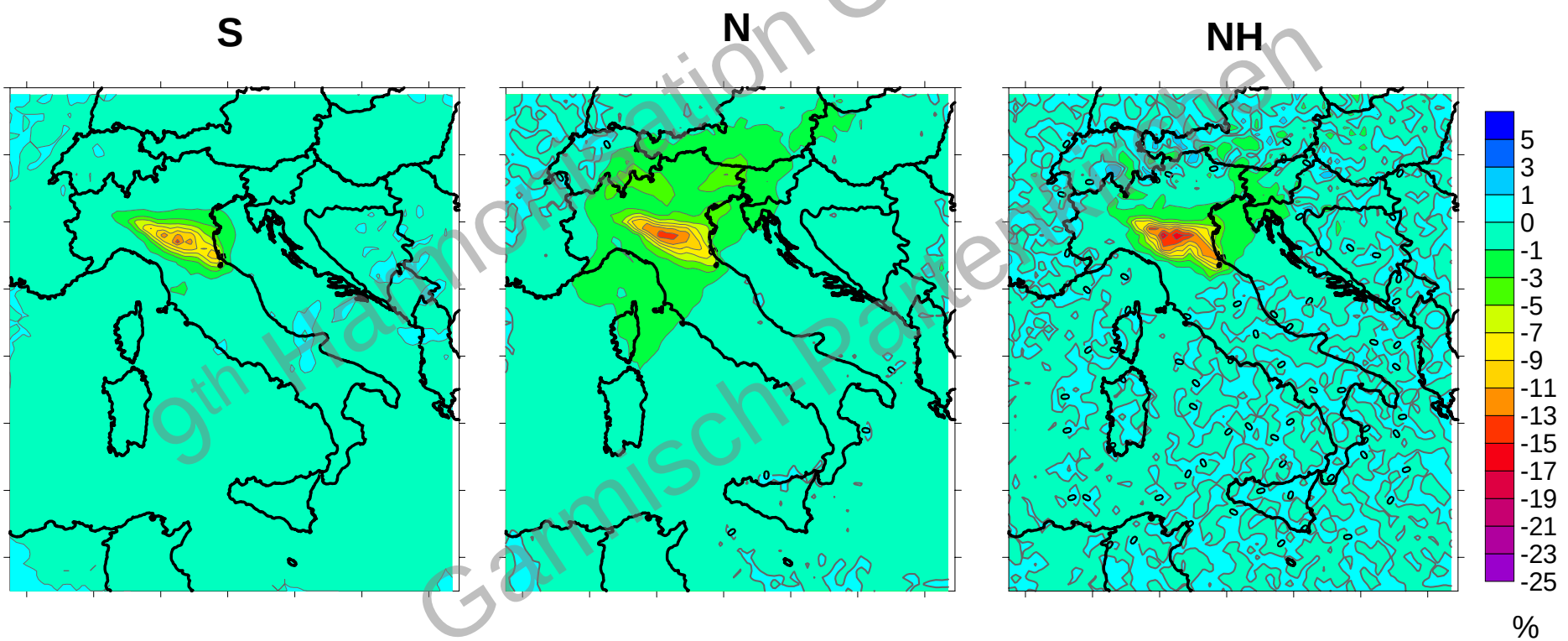


The MINNI project

Transfer matrix demo

Region 08: Emilia-Romagna

% change on total deposition, due to 25% change in emissions



Other details: poster 2.14

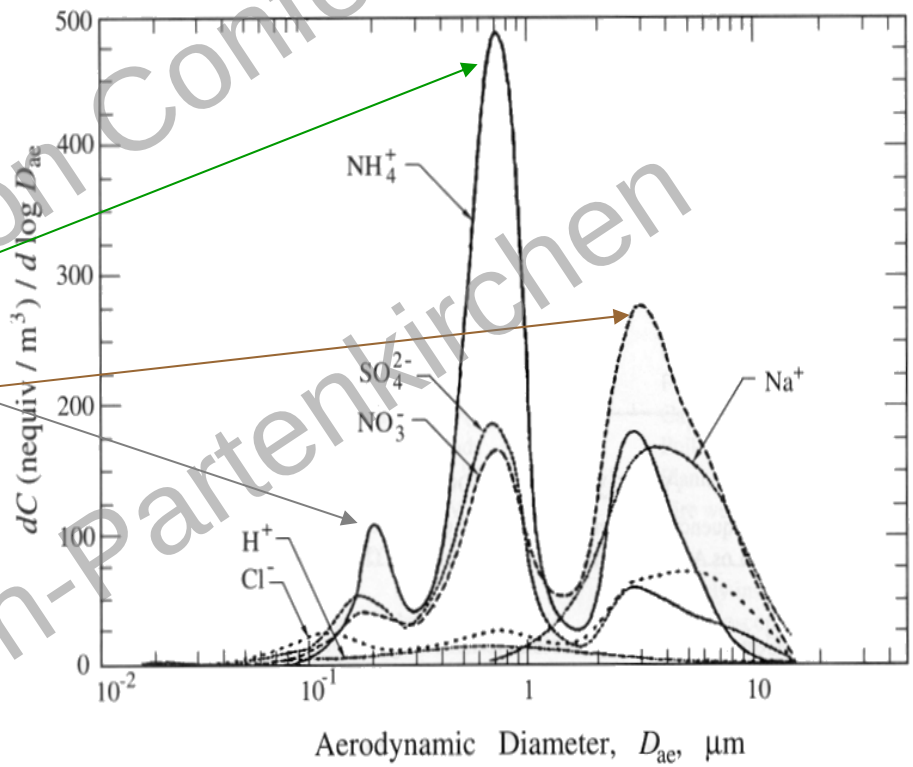
Calculation period: 1 winter week

PM in the MINNI system: AERO-3 (modal)

Aitken mode (0 - 0.1 µm)

Accumulation mode (0.1-2.5µm)

Coarse mode (PM_{10} - $PM_{2.5}$)

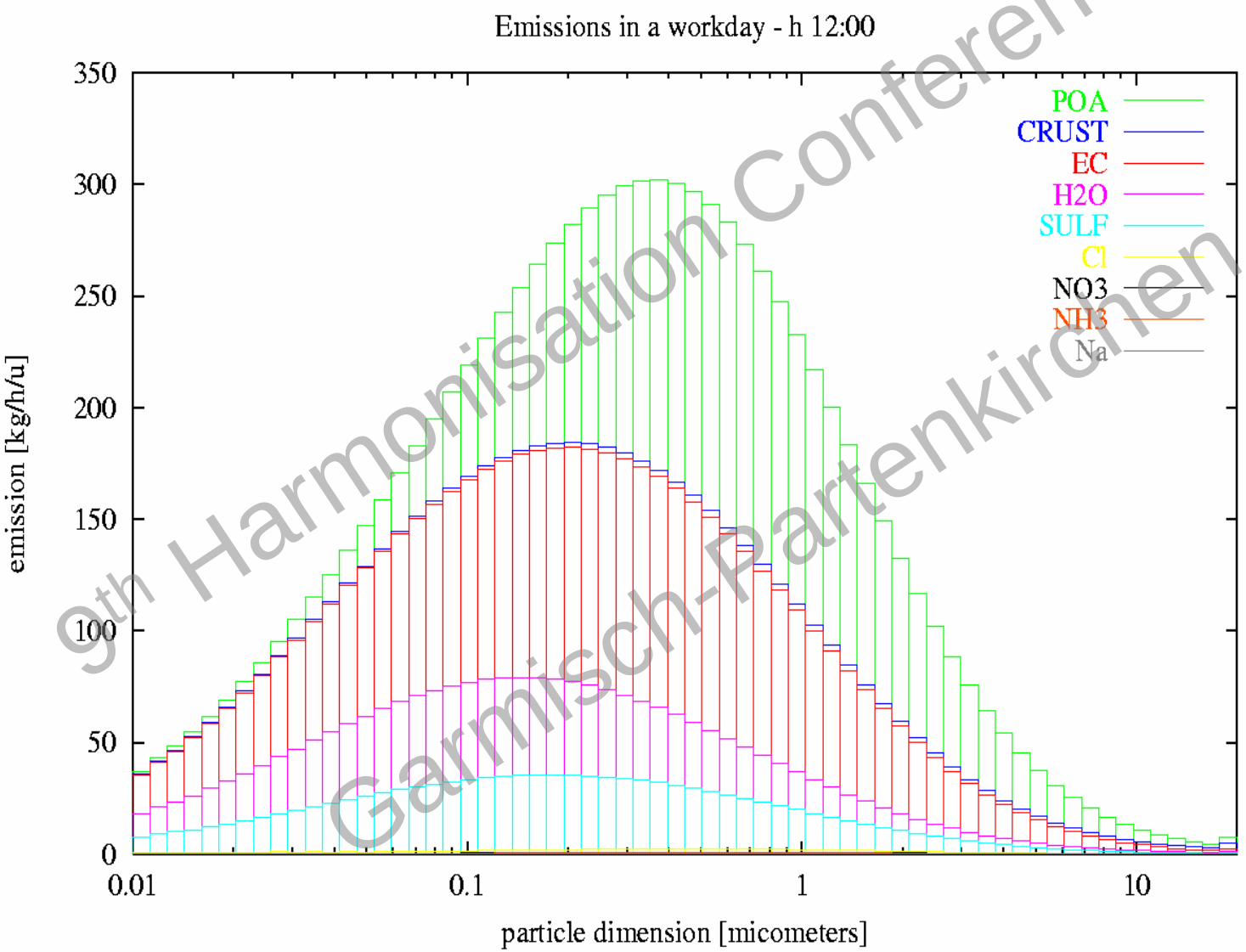


Measured size distributions of aerosol sulfate, nitrate, ammonium, chloride, sodium, and hydrogen in Claremont, CA *("Atmospheric Chemistry and Physics", Seinfeld and Pandis, 1998).*

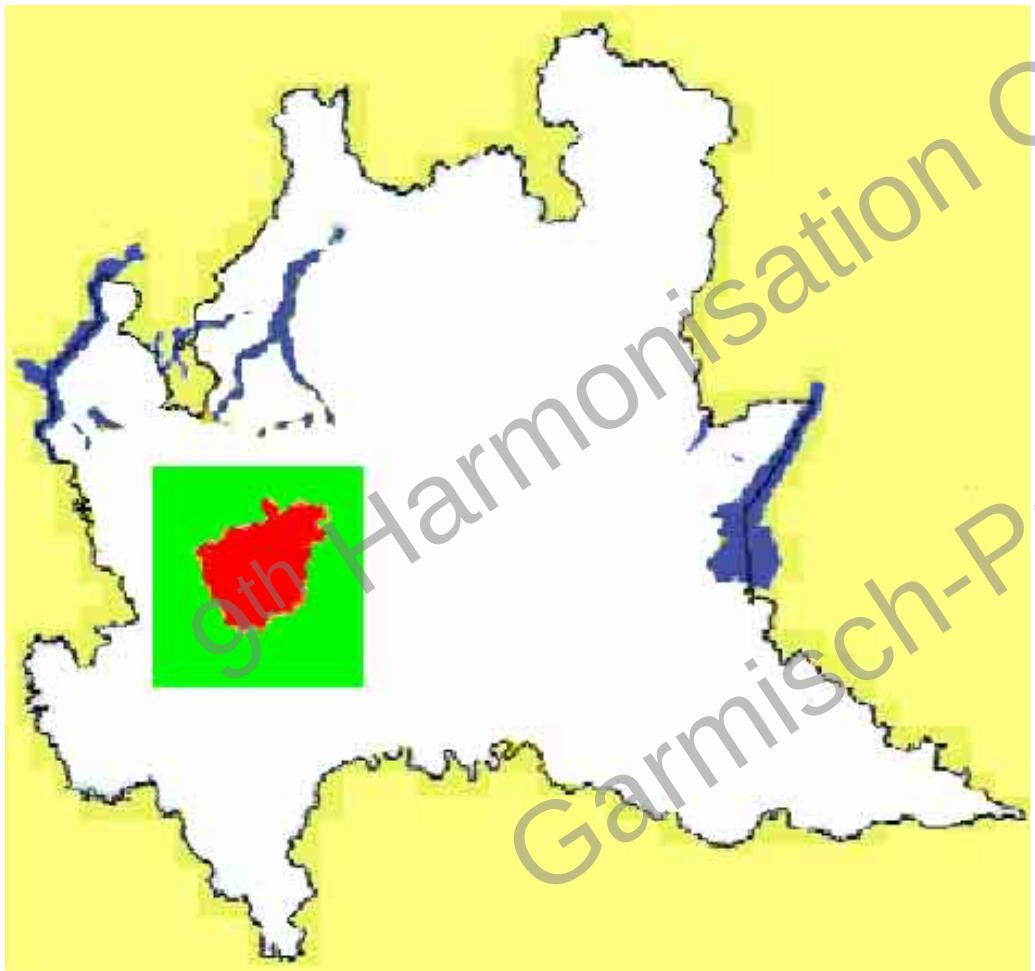
Scheduled 2005

Preliminary tests: now

PM in AERBOX (sectional)



Comparing models in a Box around Milan

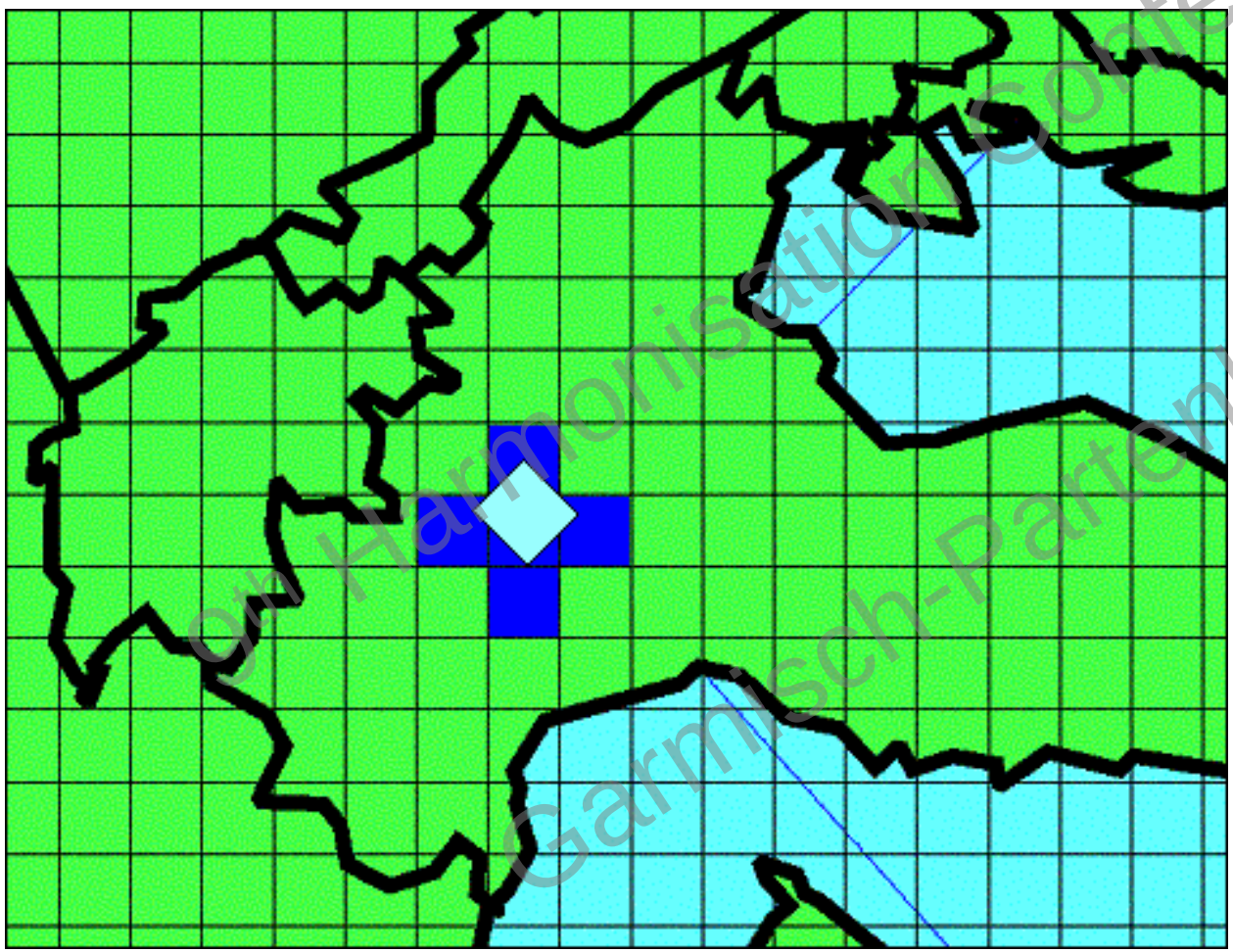


Check planned MINNI PM evolution algorithms in “typical” Italian conditions.

Looking for weak points and possible improvements

AERBOX full validation

Comparing models in a Box around Milan



50 km ×50 km

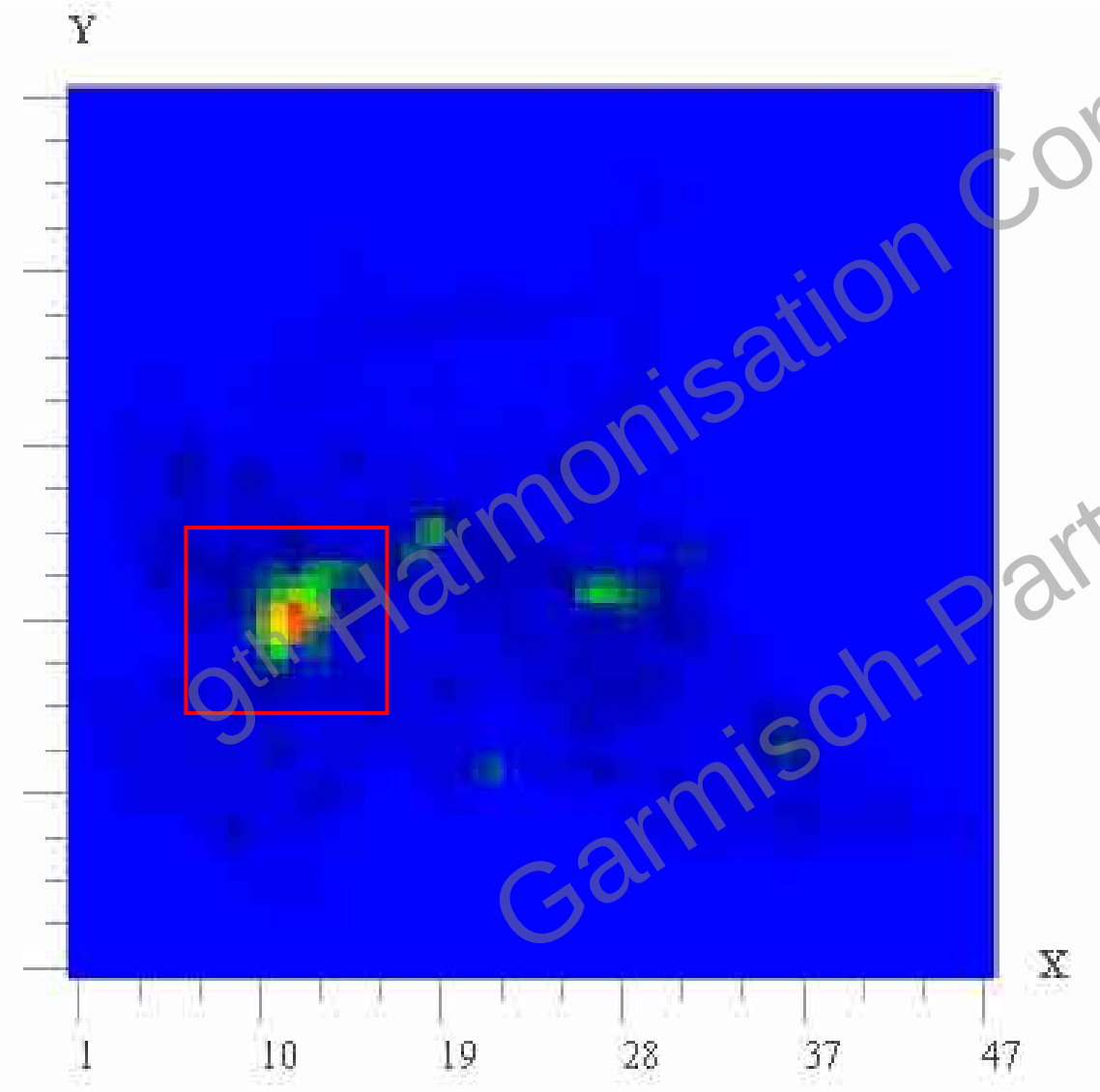
BC for gases:

EMEP

BC for PM:

Remote station

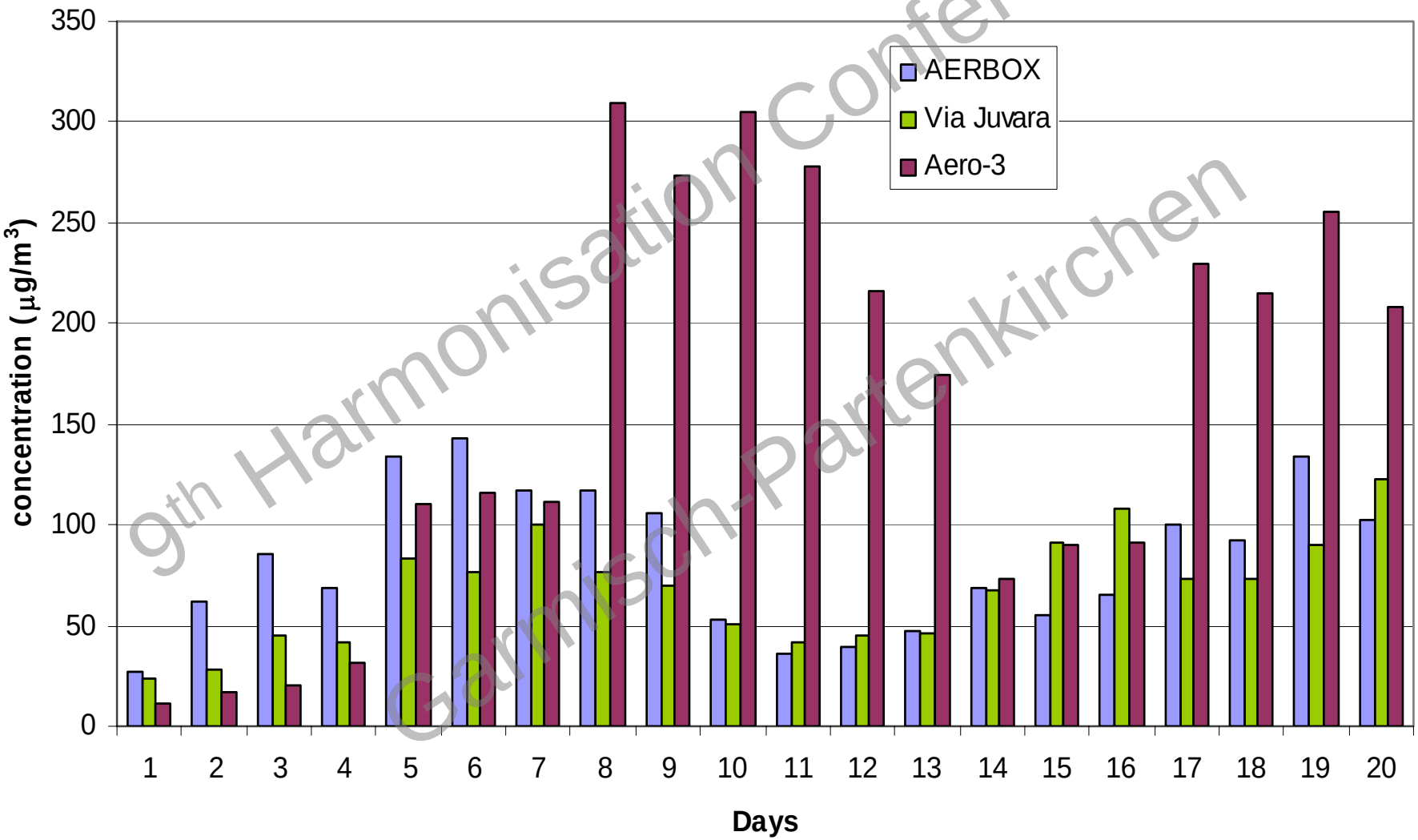
Comparing models on a Box around Milan



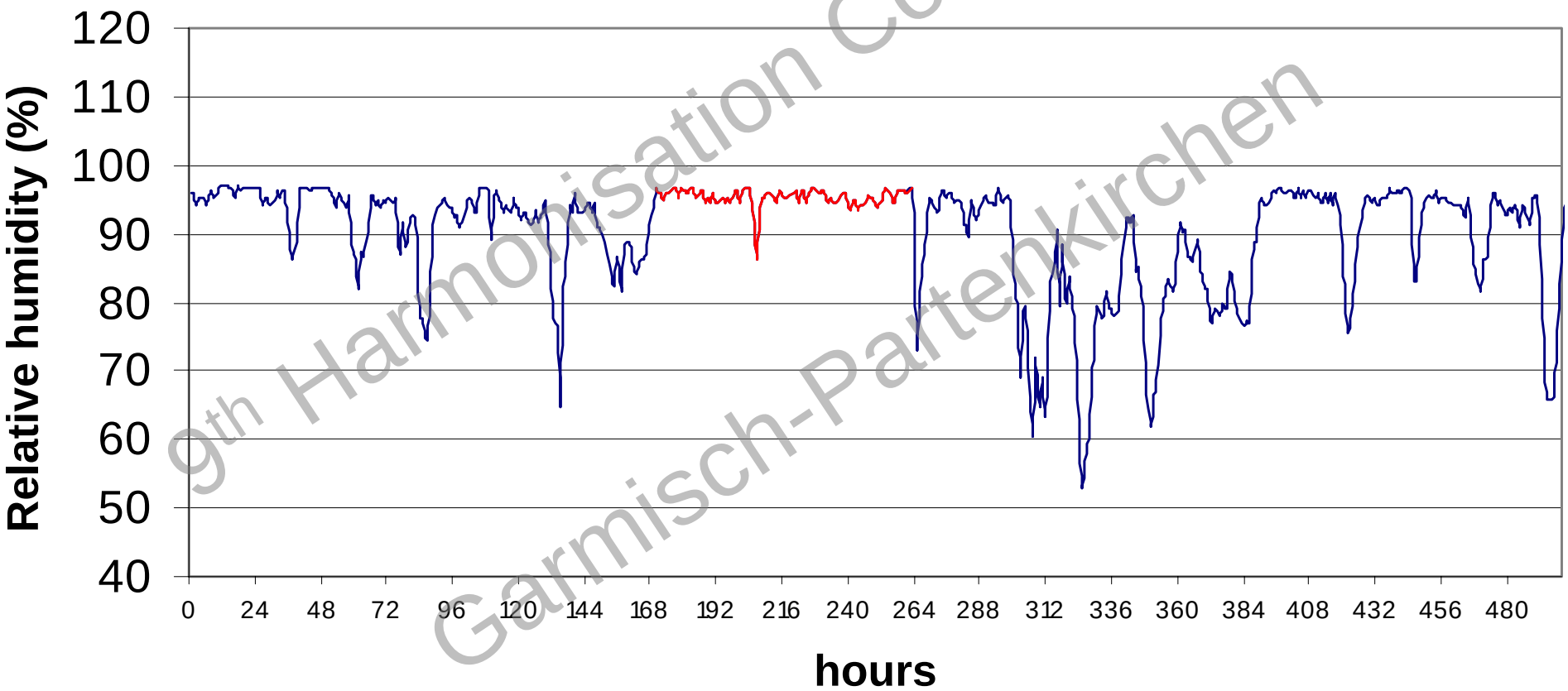
Emissions:

CITY-DELTA

Comparison results: January – PM10 daily average



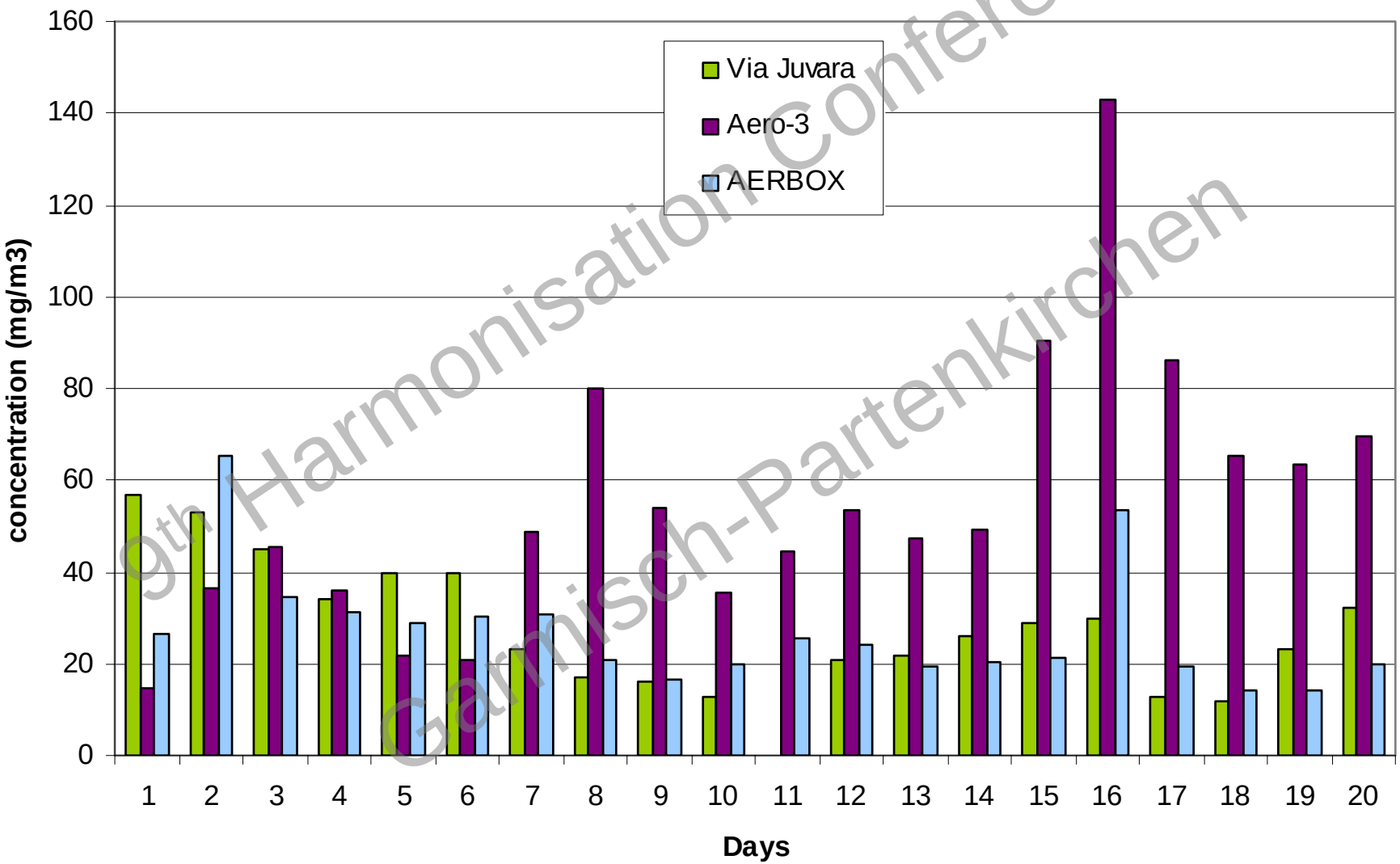
January – Relative Humidity



Comparison results: January – PM10 2- hourly

N=222	Average	Sigma	bias	nmse	cor	fa2	fb
Via Juvara	68.95	37.32	0.00	0.00	1.00	1.00	0.00
Aero-3	149.58	114.73	-80.62	1.86	0.224	0.455	-0.738
AERBOX	89.28	92.17	-20.33	1.37	0.268	0.581	-0.847

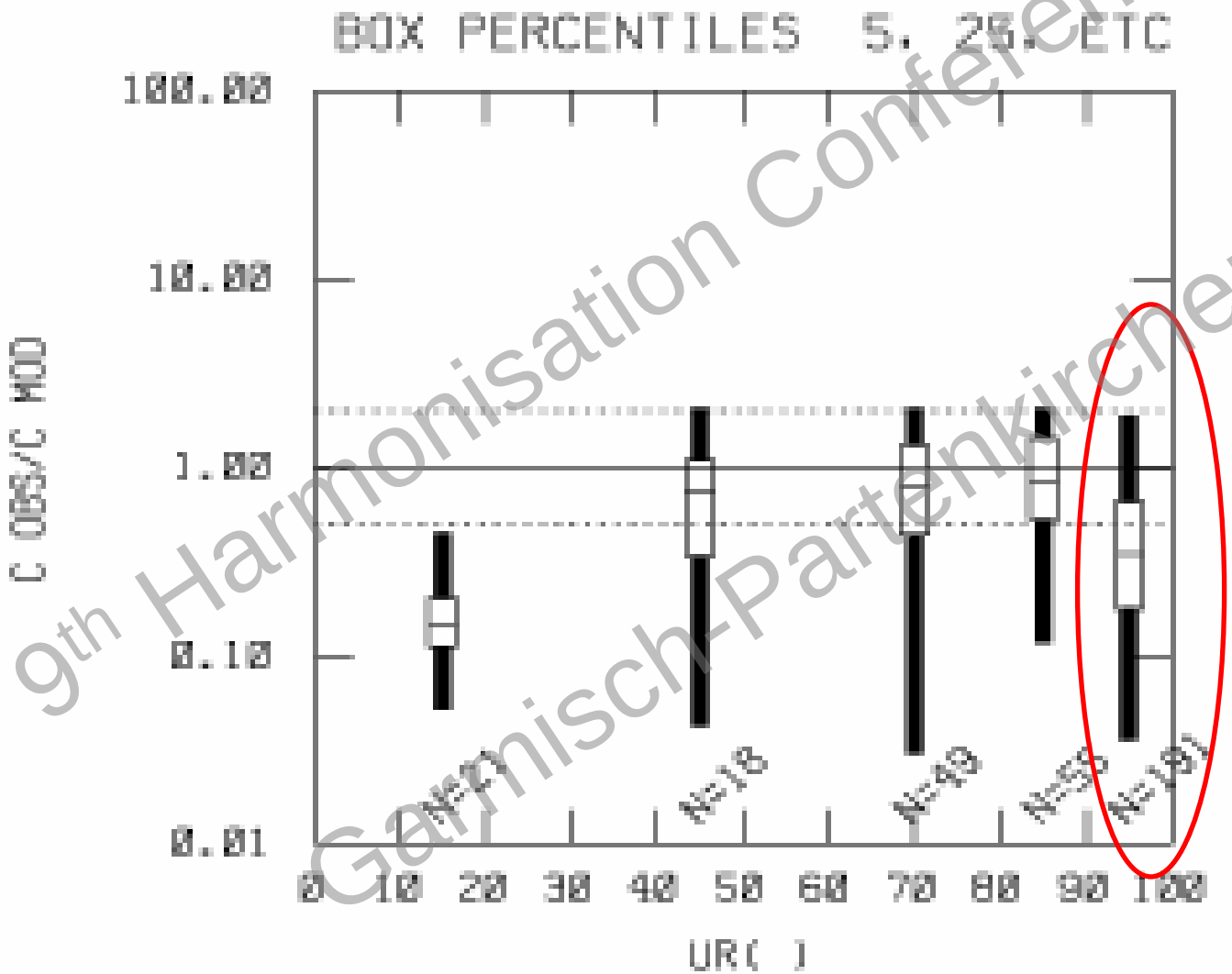
Comparison results: April – PM10 daily average



Comparison results: April – PM10 2-hourly

N=174	Average	Sigma	bias	nmse	cor	fa2	fb
Via Juvara	31.06	19.78	0.00	0.00	1.00	1.00	0.00
Aero-3	55.18	42.18	-24.11	1.87	-0.276	0.443	-0.723
AERBOX	28.75	23.50	2.32	0.81	0.238	0.741	-0.172

Aero-3 residual analysis: Relative humidity



Conclusions

- The complex sectional model AERBOX performs better than the modal model Aero-3
- AERBOX is likely to be validated (full year running)
- Computation times are enormously different
- Aero-3 should be tested and hopefully improved before starting long-term simulations for the MINNI project.