Operational validation of SILAM model in differently inhabited areas

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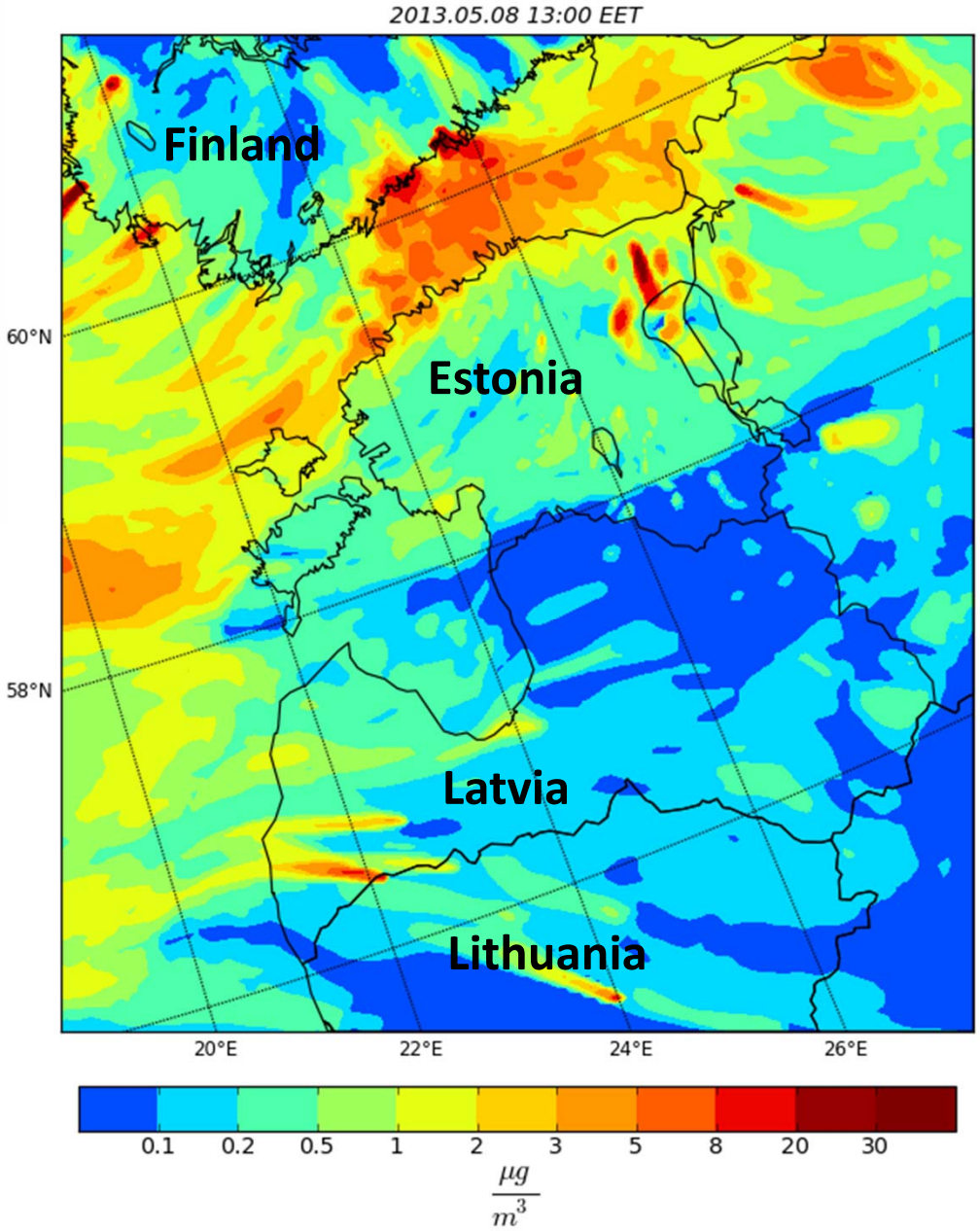
Estonian pre-operational SILAM model application in „Eastern Baltic“ domain:

how reliable it is?

- NOx, SO_2 , PM10, M2.5
- 3.3 km resolution
- driven by HIRLAM (Estonia)
- boundary fields of pollutants – SILAM (Finland)
- meteo boundaries – ECMWF

Emission data:

- in Estonia – national, 0.5 – 1 km resolution
- outside – TNO MACC, 7 km



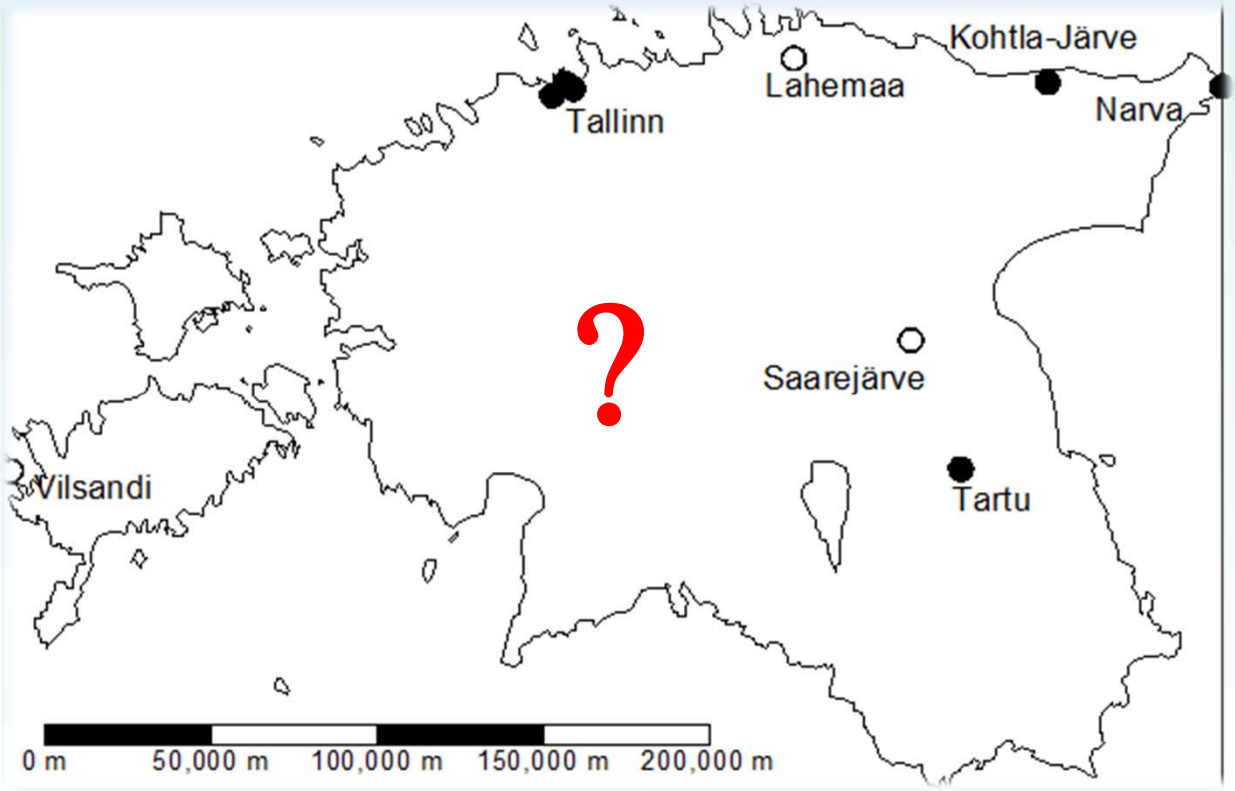
Validated
so far

Ots, R., Loot, A., Kaasik, M. (2013). Scale-dependent and seasonal performance of SILAM model in Estonia. Steyn, D., Timmermans, R. (Eds.). Air Pollution Modelling and its Application XXII, Springer (in press).

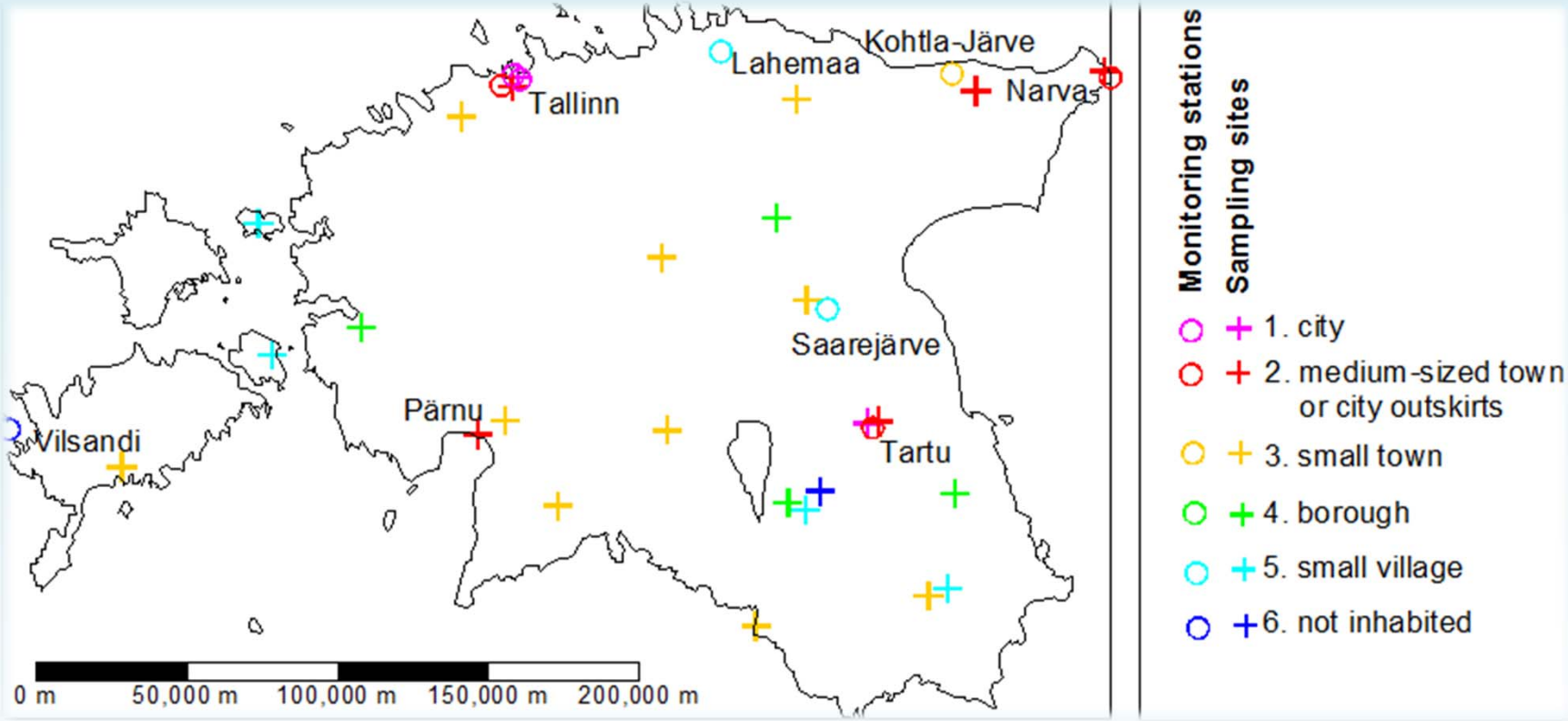
- Urban peak concentrations represented rather well.
- Urban averages underestimated.
- Backround NOx rather well.
- Summertime PM underestimated (no wind-blown dust).

Validated
so far

6 urban stations and 3 rural backgroud stations non-uniformly distributed – not enough for good validation!



Monitoring stations + passive samplers



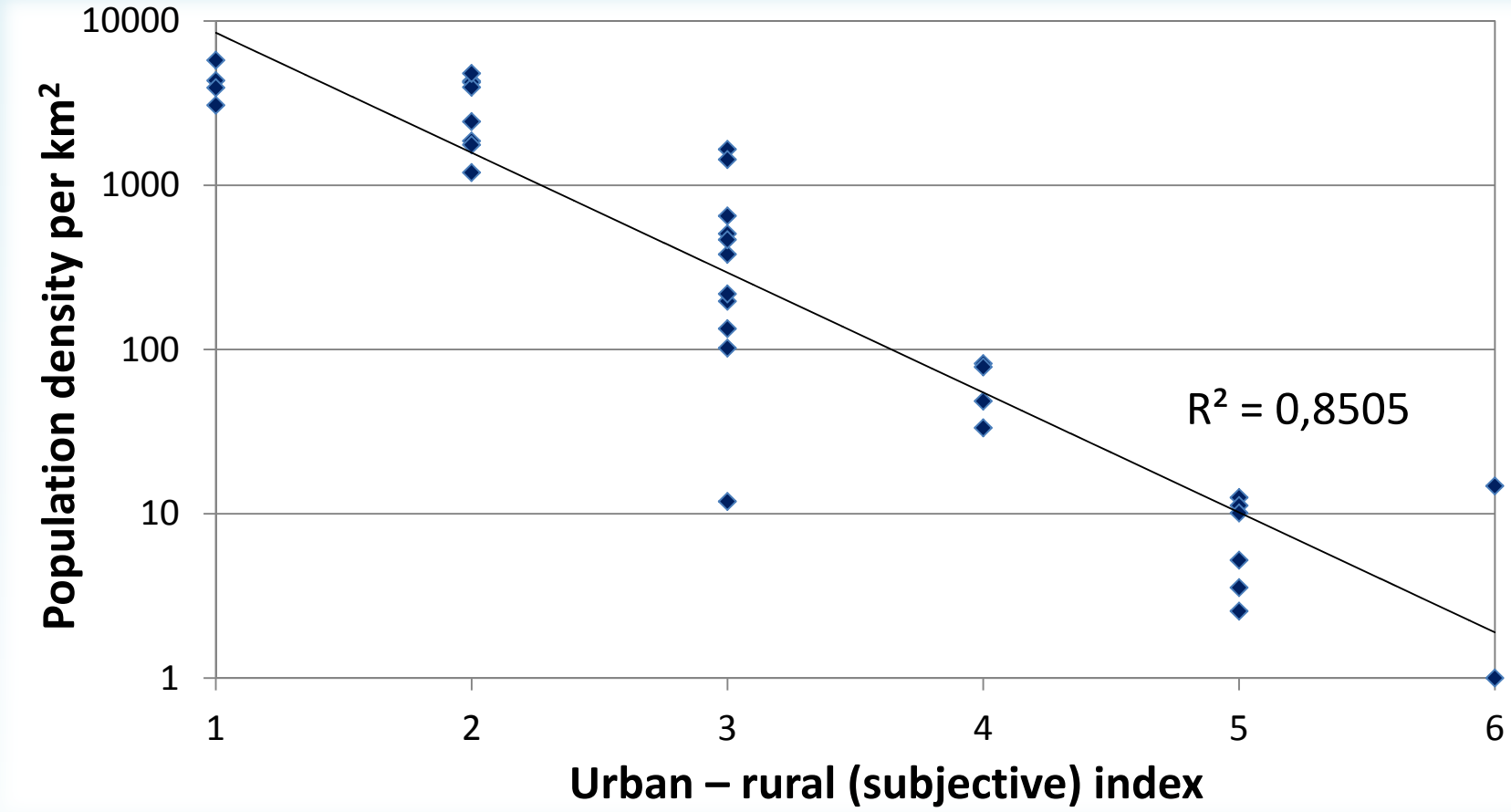
Two-week series in 2012:

(26 sites)

- 13.02 – 26.02
- 14.05 – 27.05
- 27.08 – 09.09
- 19.11 – 03.12

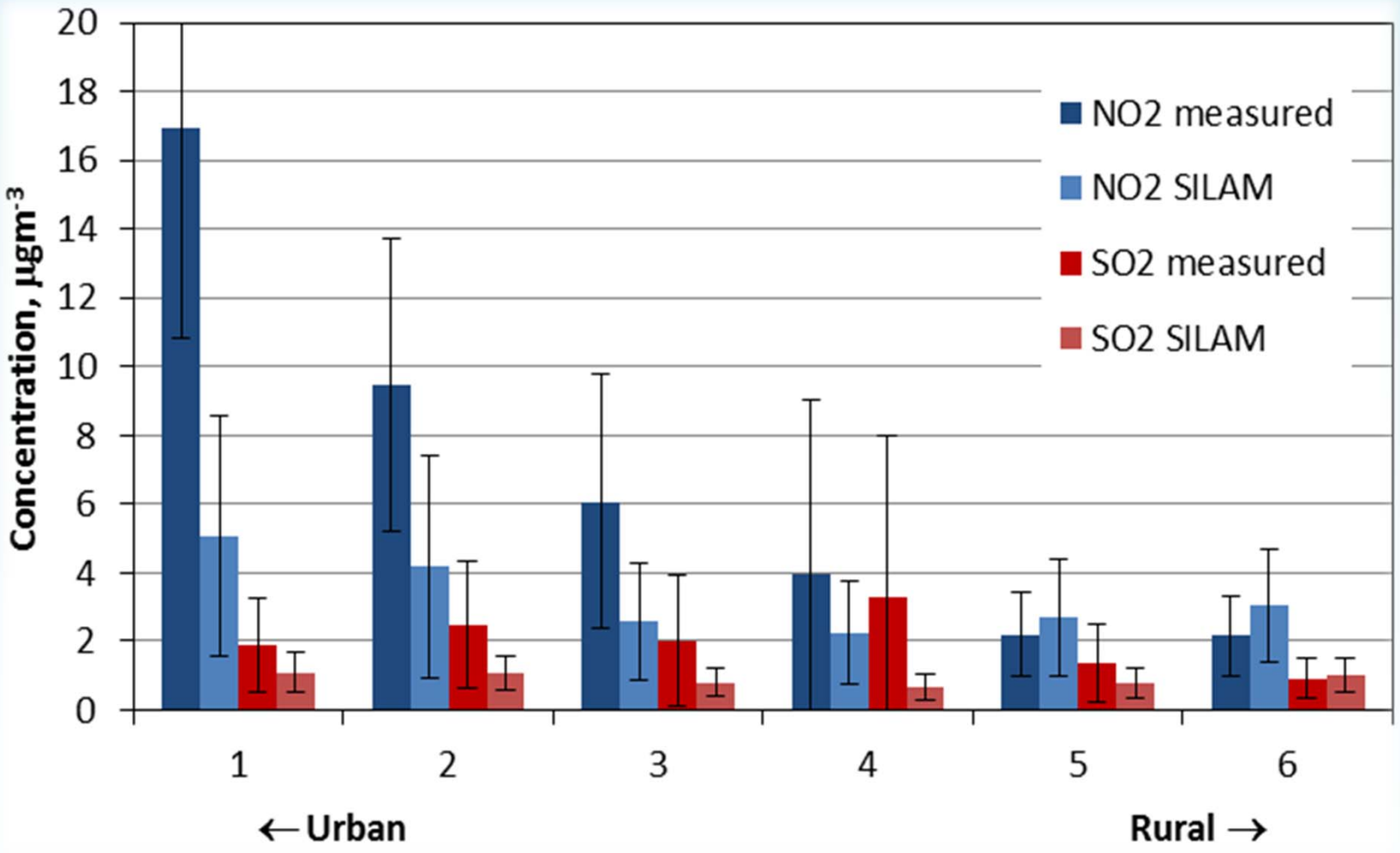
Average concentrations

How the classification performs?

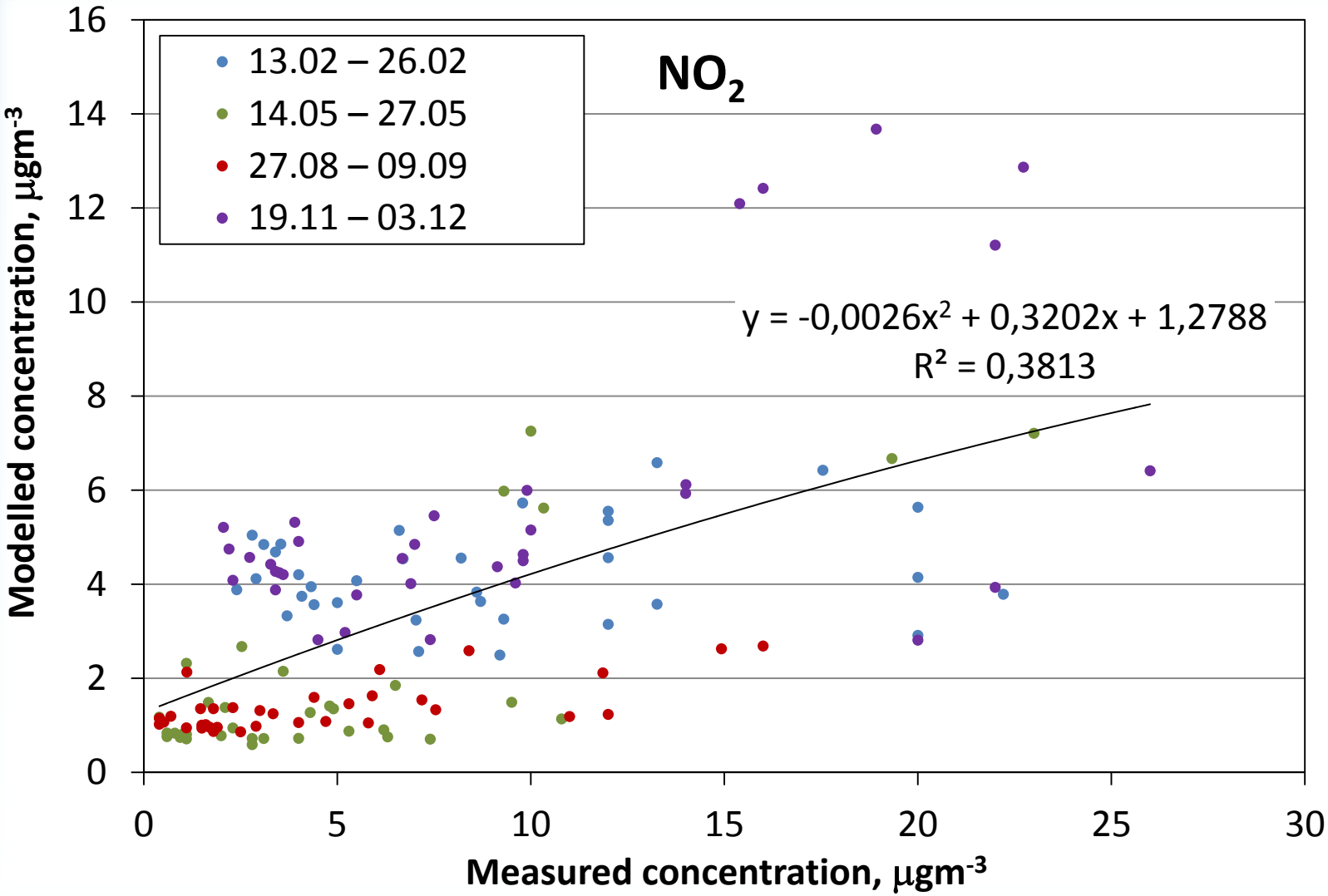


Population density in 3x3 km cells vs. subjective urban – rural classes.

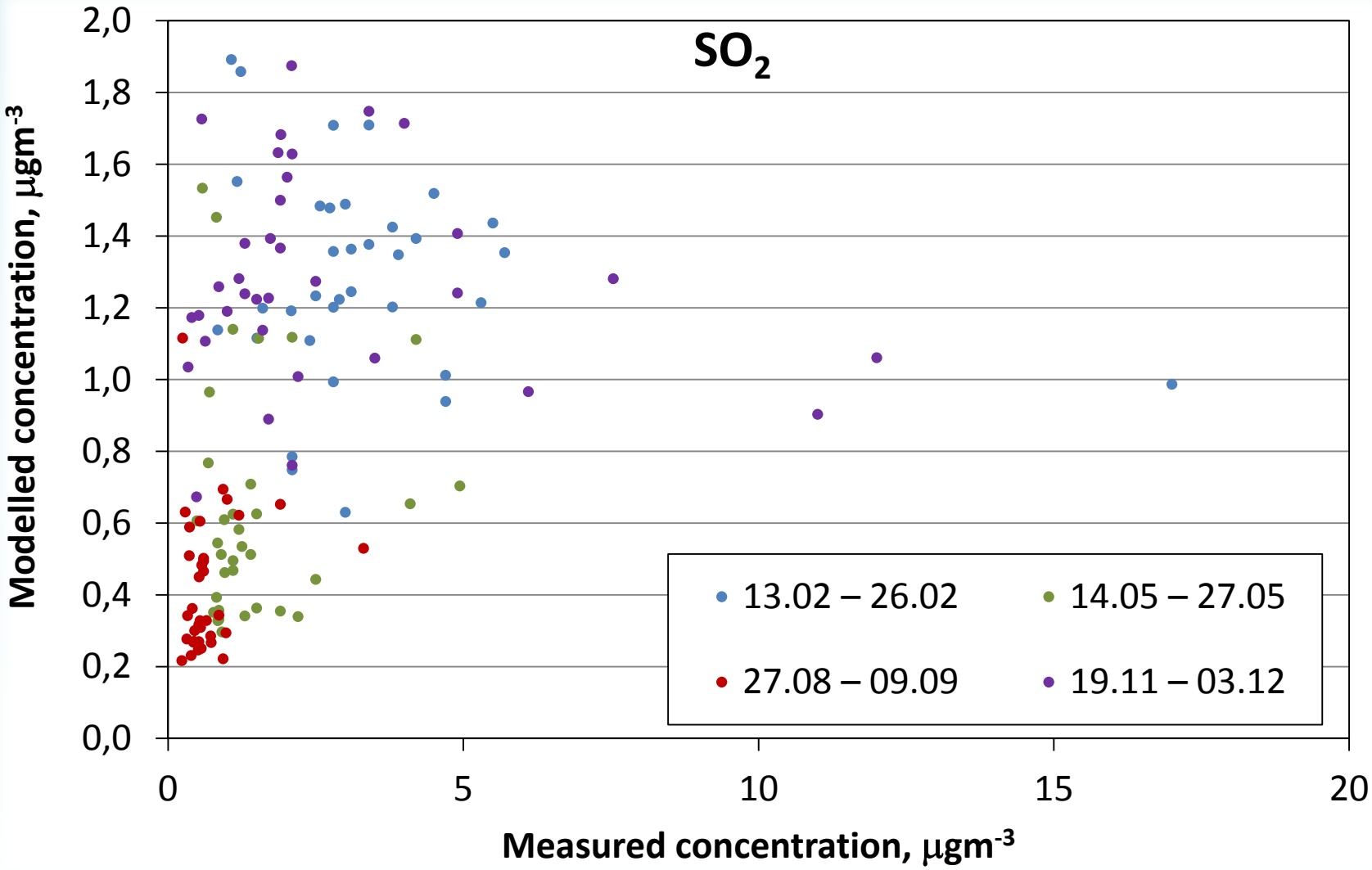
Results: measured vs. modelled



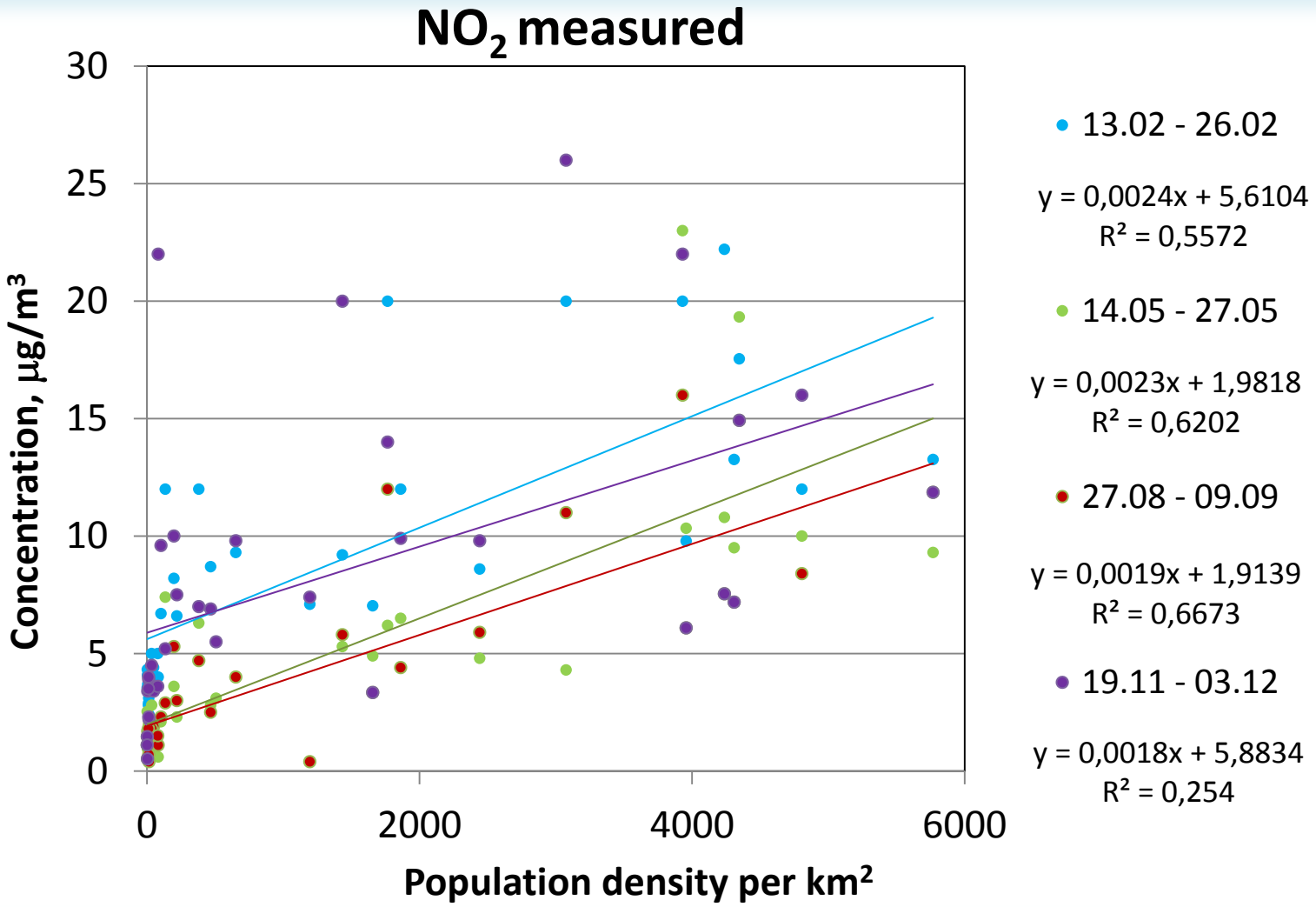
Results: measured vs. modelled



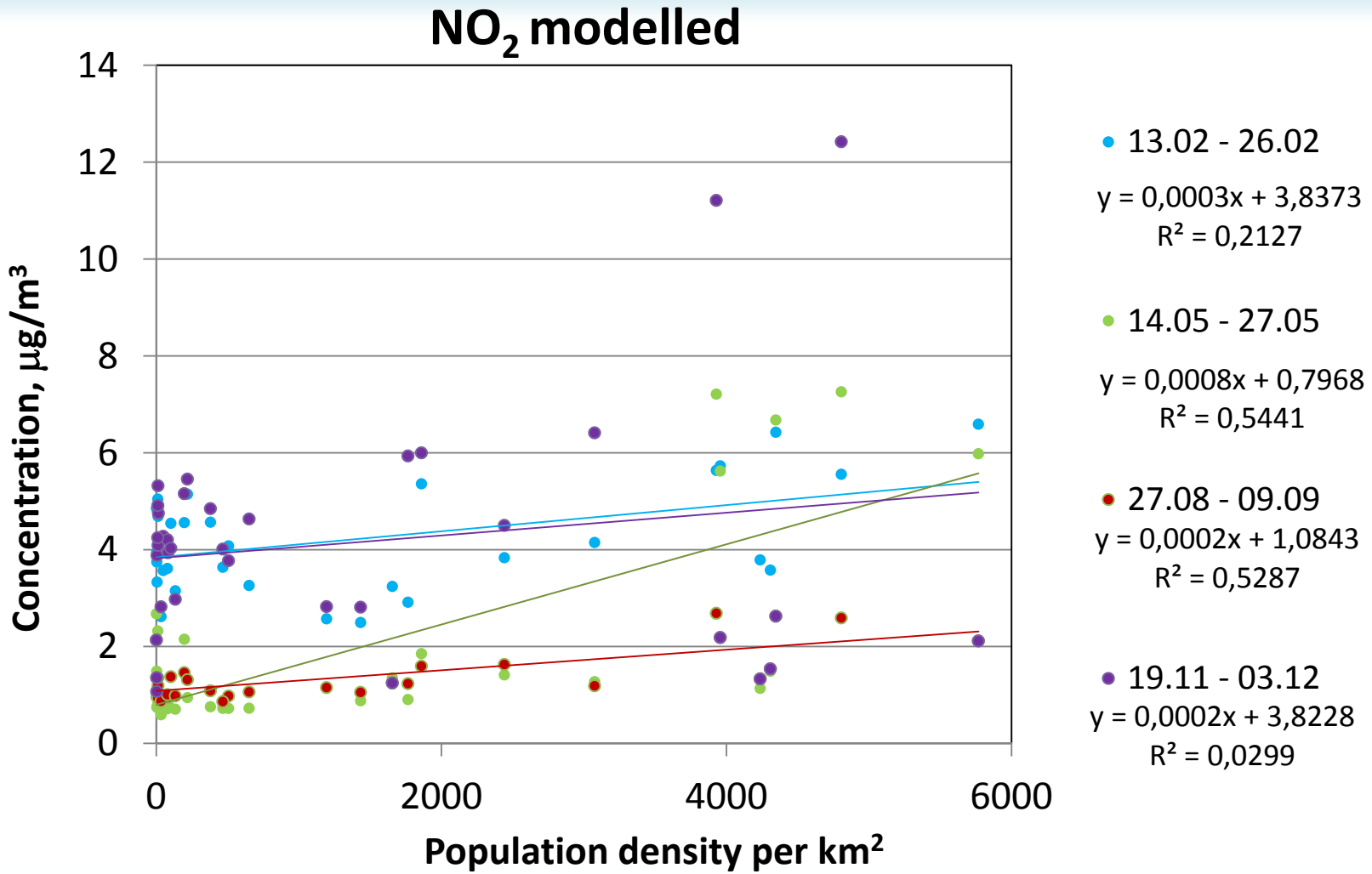
Results: measured vs. modelled



Results: concentrations vs. population density



Results: concentrations vs. population density



Other results

- No substantial dependence of SO_2 concentrations on urbanisation/population density – expected.
- Black carbon constitutes only a small fraction of PM2.5 or PM10, but is considerably correleted with modelled PM2.5: correlations 0.2 – 0.6 (nearly as modelled – measured PM in monitoring stations.
- Site-wise modelled – measured correlations of NO_2 and SO_2 are substantial in summer, but don´t exist in winter:

Campaign, 2012	NO_2	SO_2
13.02 – 26.02	0.09	-0.07
14.05 – 27.05	0.78	0.39
27.08 – 09.09	0.68	0.53
19.11 – 03.12	0.46	-0.10

Conclusions

- Estonian application of SILAM tends to “smooth out” the urban-rural differences – urban emissions underestimated?
- Urban peak levels have been reproduced fairly – is the diurnal cycle of emissions (and perhaps dispersion conditions) overestimated?
- Grid cell resolution (3.3 km) may be still critical for small towns.

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