

Data from a different cities within the East Sweden Air Quality Management Association

Jenny Lindvall, City of Stockholm

Study area

- Gävle, 75 000 inhabitants
- Norrköping, 97 000 inhabitants
- Linköping, 115 000 inhabitants
- Visby, 23 000 inhabitants

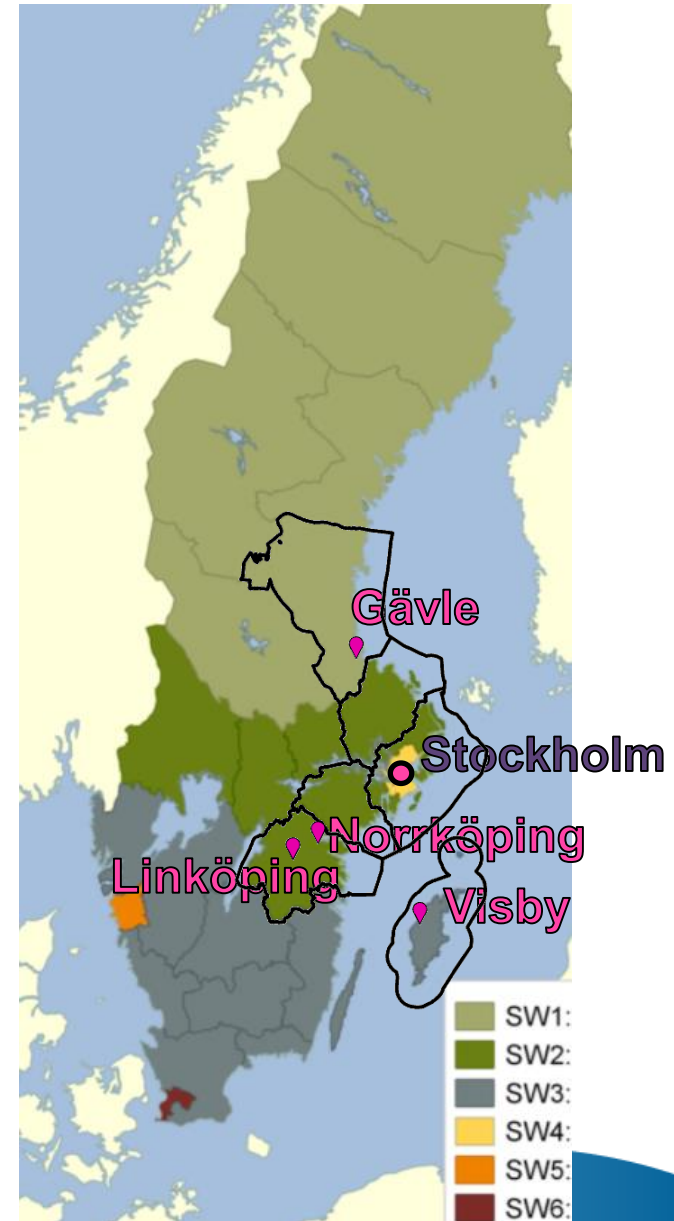
Traffic sites in all 4 cities

Urban background sites in Norrköping and Visby

+ recap from Stockholm

Each county modeled separately, usually every fifth year with a climatological approach

Substances included: NO₂ and PM10



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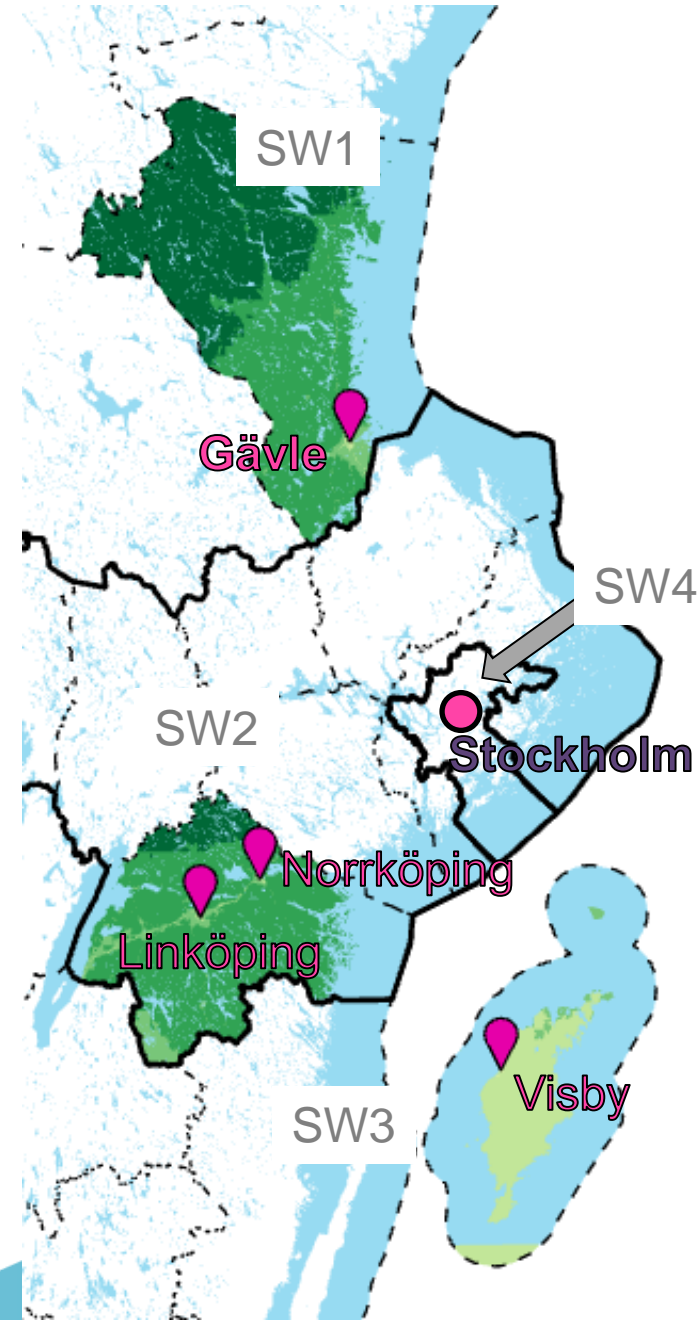
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Air quality zones



Specification of the model data

Models

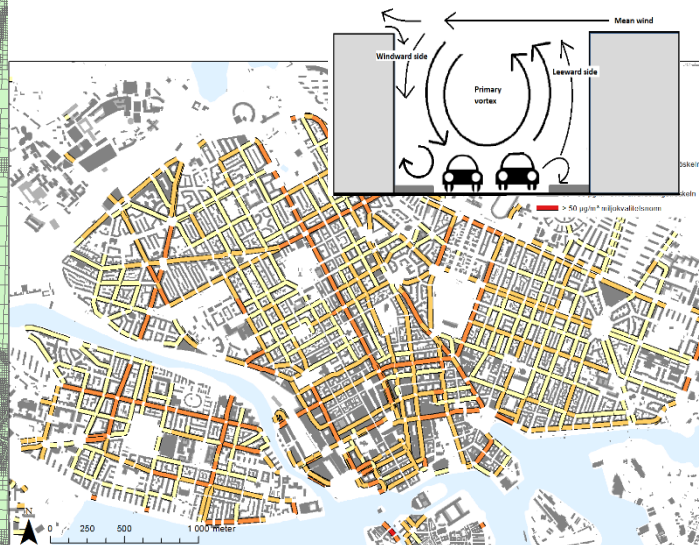
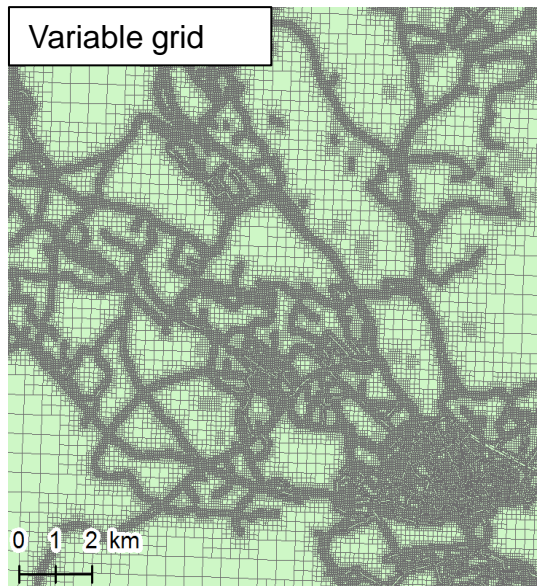
- Airviro Gaussian model with a variable grid (35-500 m)
- Airviro OSPM (Open Street Pollution Model)

NERI, Department of Atmospheric Environment in Denmark

- Simplification: the same concentration on both sides of the street canyon (the highest)

Emission data

- Local emission data (mostly bottom-up data)



Urban background

Torkel Kn, Stockholm

- **NO₂** yearly mean: 10.2 $\mu\text{g}/\text{m}^3$
- $\pm 20\%$: 8.2 – 12.2 $\mu\text{g}/\text{m}^3$



Torkel Kn, Stockholm

- **PM₁₀** yearly mean: 11.2 $\mu\text{g}/\text{m}^3$
- $\pm 20\%$: 8.9 – 13.4 $\mu\text{g}/\text{m}^3$



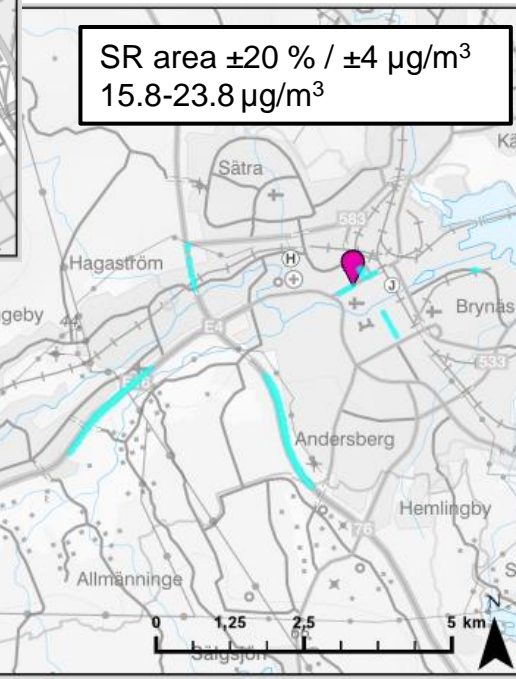
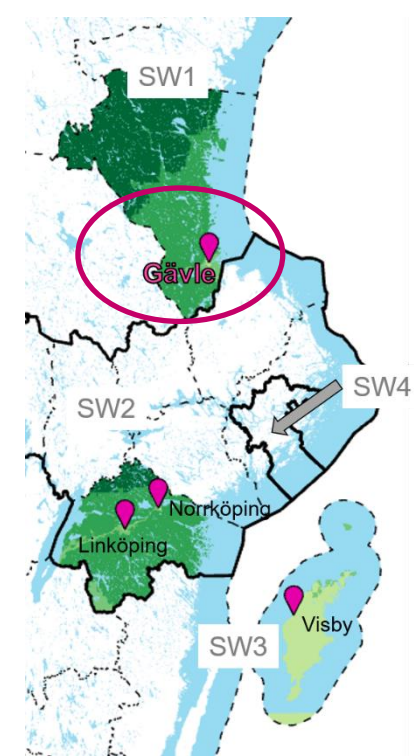
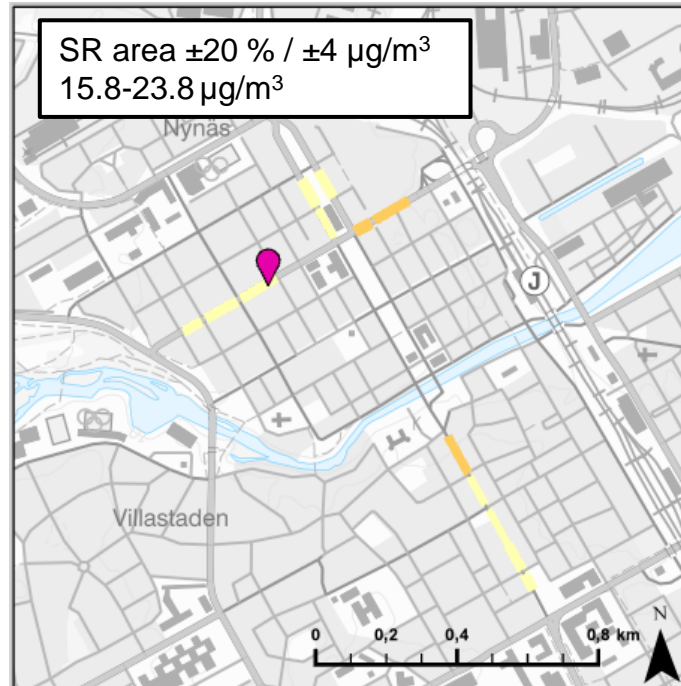
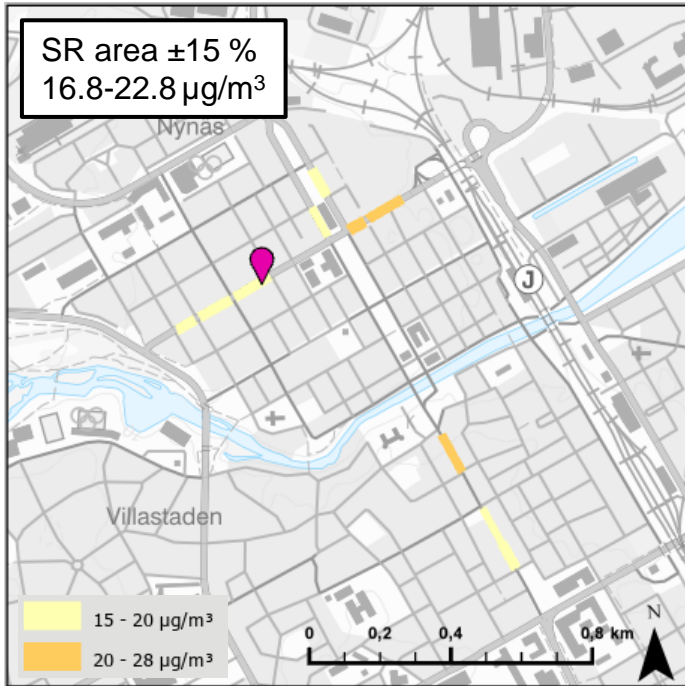
Torkel Kn, Stockholm

- **PM₁₀** yearly mean: 11.2 $\mu\text{g}/\text{m}^3$
- $\pm 10\%$: 10.1 – 12.3 $\mu\text{g}/\text{m}^3$



PM10 year – traffic Gävle

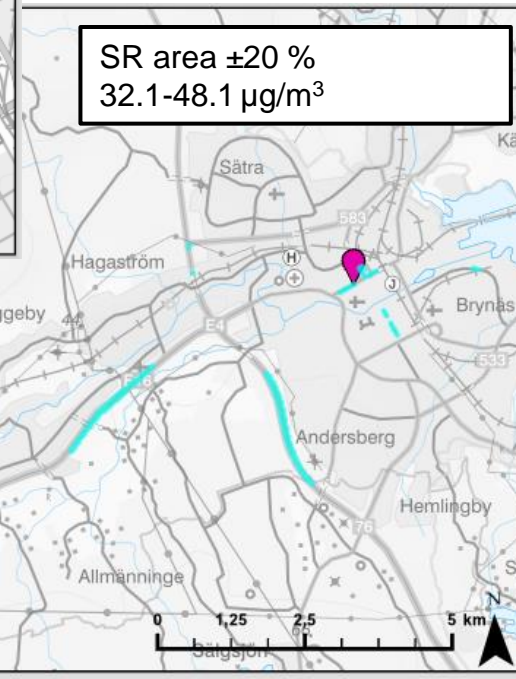
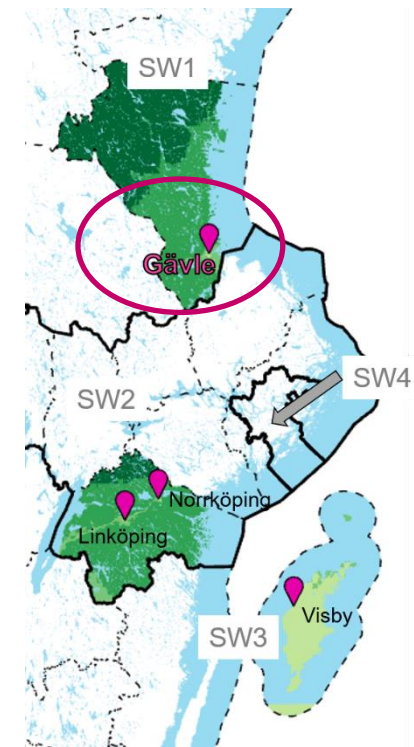
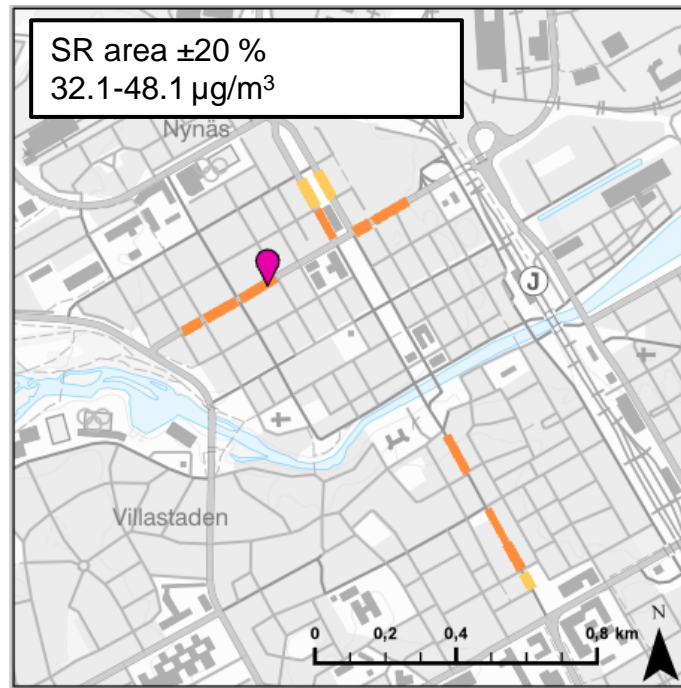
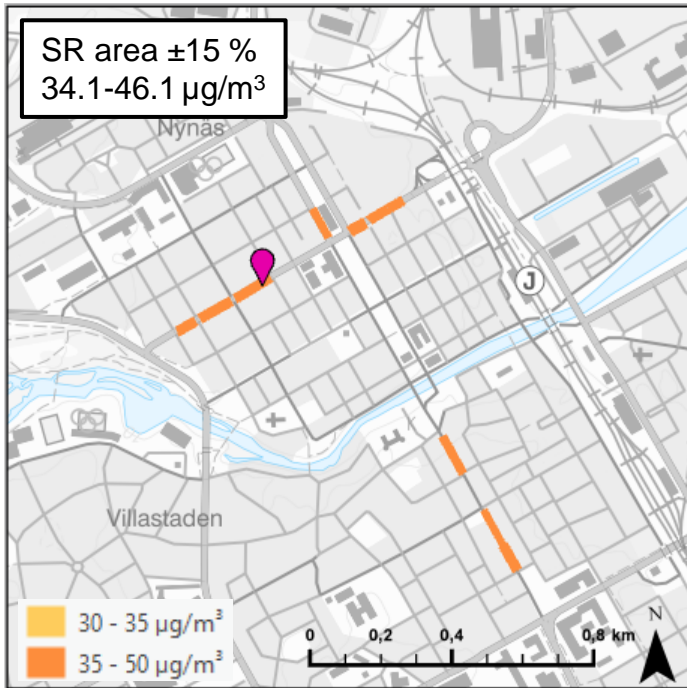
Staketg 22, Gävle, PM10 annual mean (2020): $19.8 \mu\text{g}/\text{m}^3$



A few highways outside the city is also included in the SR area with $\pm 20\%$ / $\pm 4 \mu\text{g}/\text{m}^3$:

PM10 day – traffic Gävle

Staketg 22, Gävle,
PM10 90th percentile daily mean (2020): $40.1 \mu\text{g}/\text{m}^3$

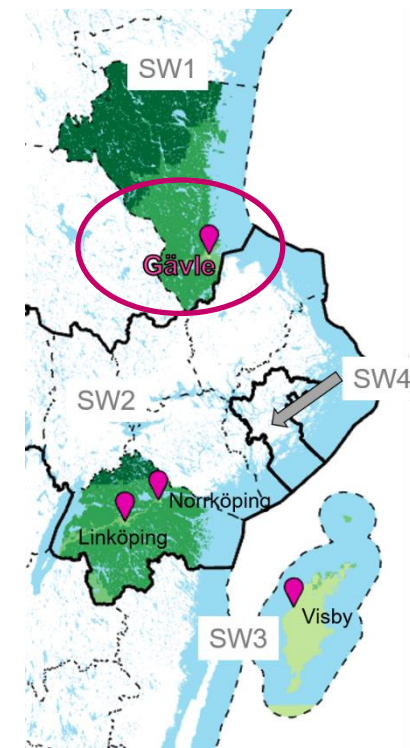
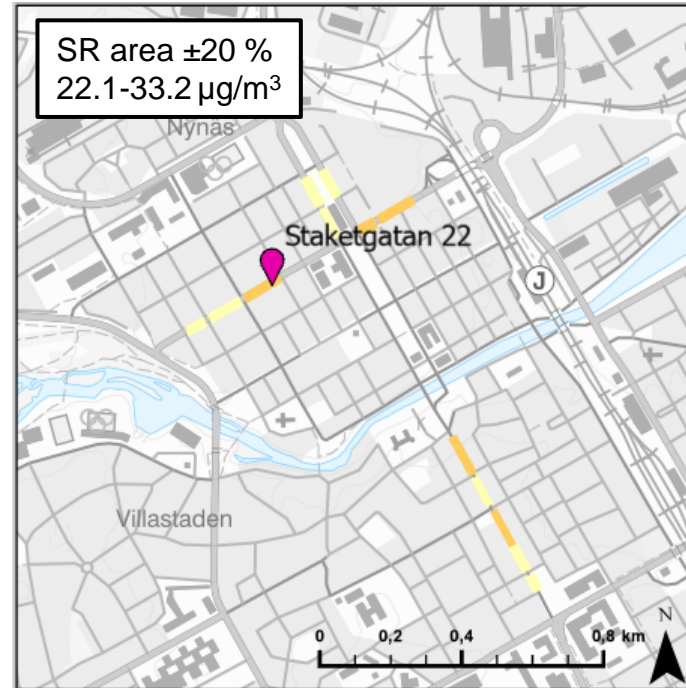
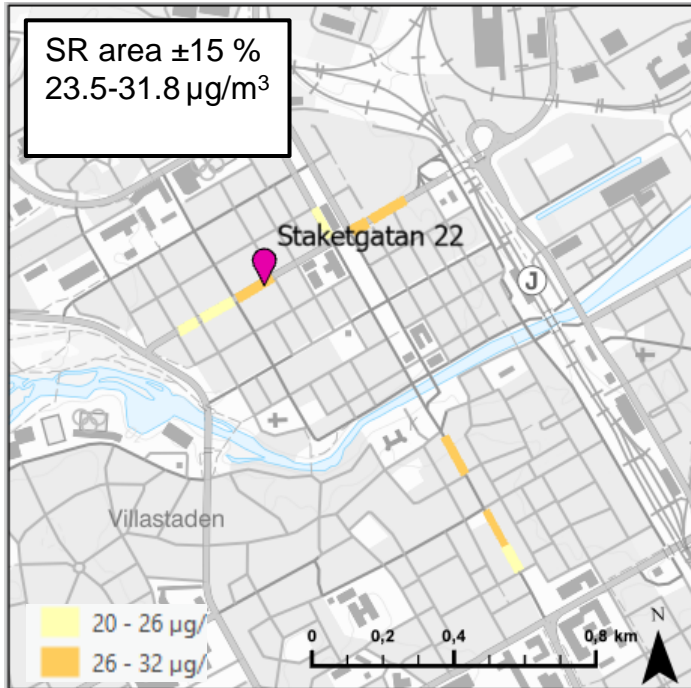


SR area very similar to annual mean
- BUT daily mean calculated based on empirical formulas

A few highways outside the city is also included in the SR area with $\pm 20\%$:

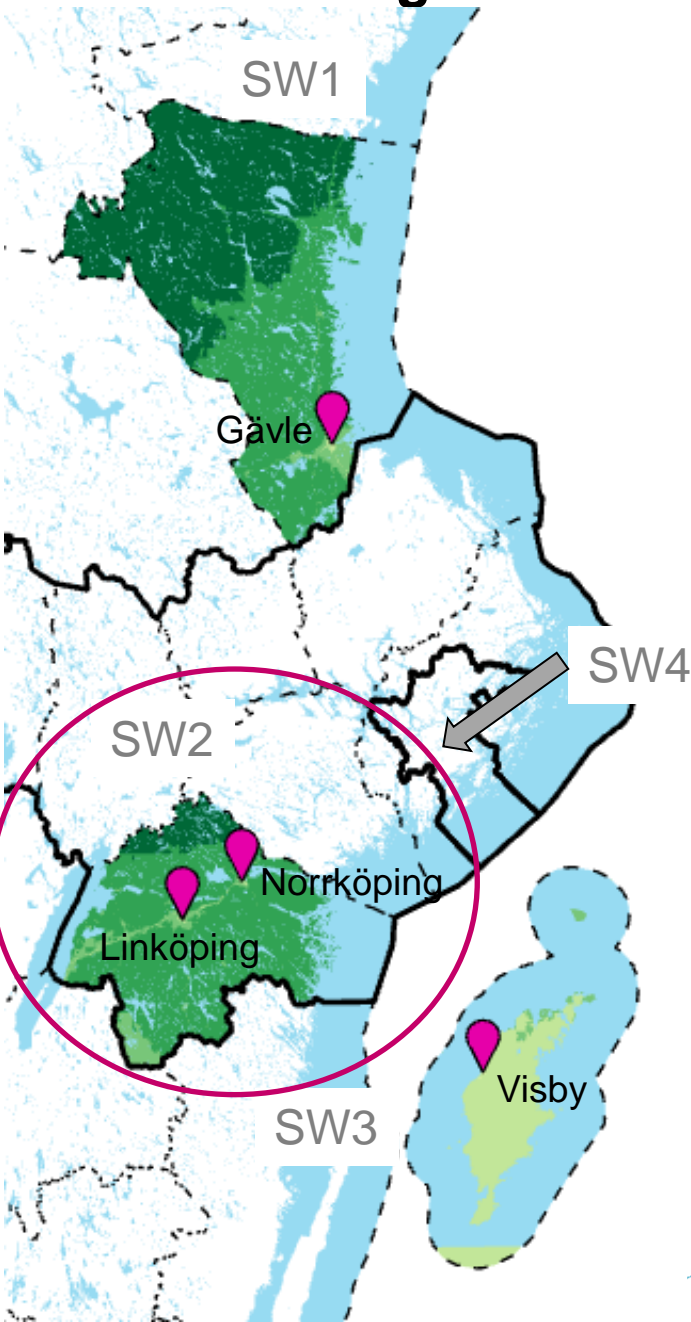
NO₂ year – traffic Gävle

Staketg 22, Gävle, NO₂ annual mean: 27.7 µg/m³



For NO₂ year, only street canyons in central Gävle included in the SR area

Östergötland county - Norrköping and Linköping



- Norrköping, 97 000 inhabitants
- Linköping, 115 000 inhabitants

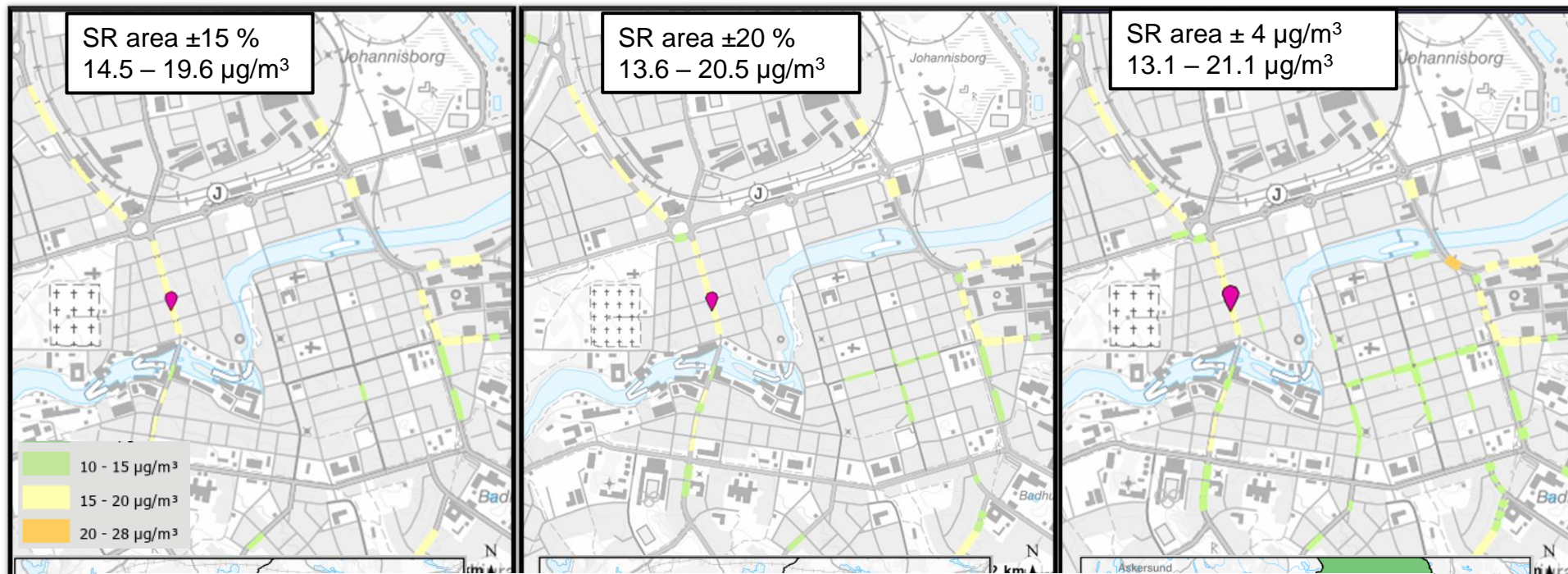
Zone SW2 (Middle Sweden)

2 fixed AQ monitoring traffic sites
(Norrköping + Linköping)

1 fixed AQ monitoring urban background site
(Norrköping)

PM10 year – traffic site

Kungsgatan 32, **Norrköping**, model annual mean (2022): $17.1 \mu\text{g}/\text{m}^3$



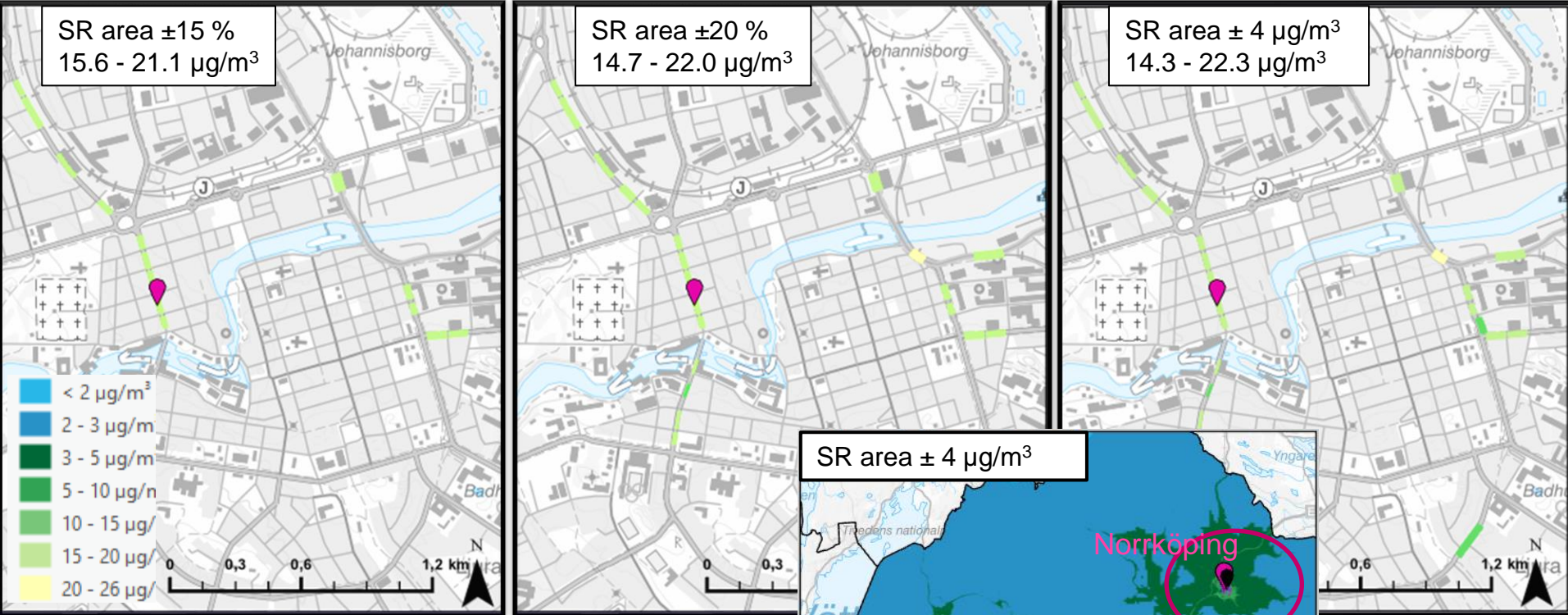
A few highway links + street canyons in smaller cities are included in the SR area (purple areas)



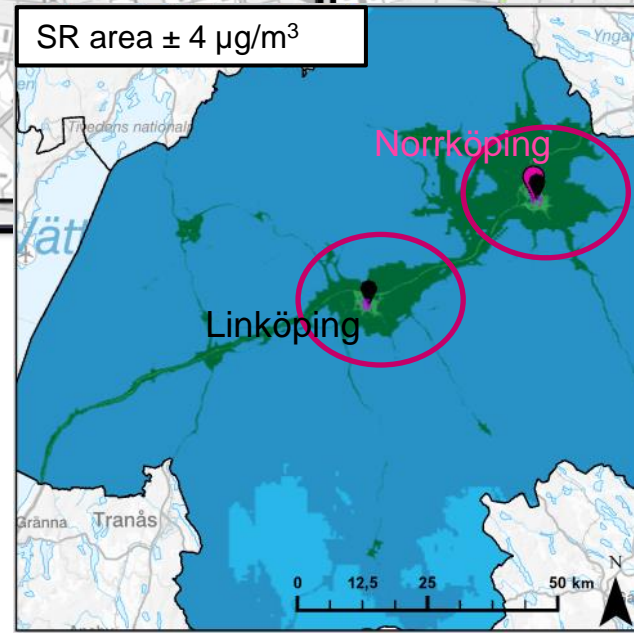
NO₂ year – traffic site

Kungsg 32, **Norrköping**, Östergötland

NO₂ annual mean (2022): 18.3 µg/m³



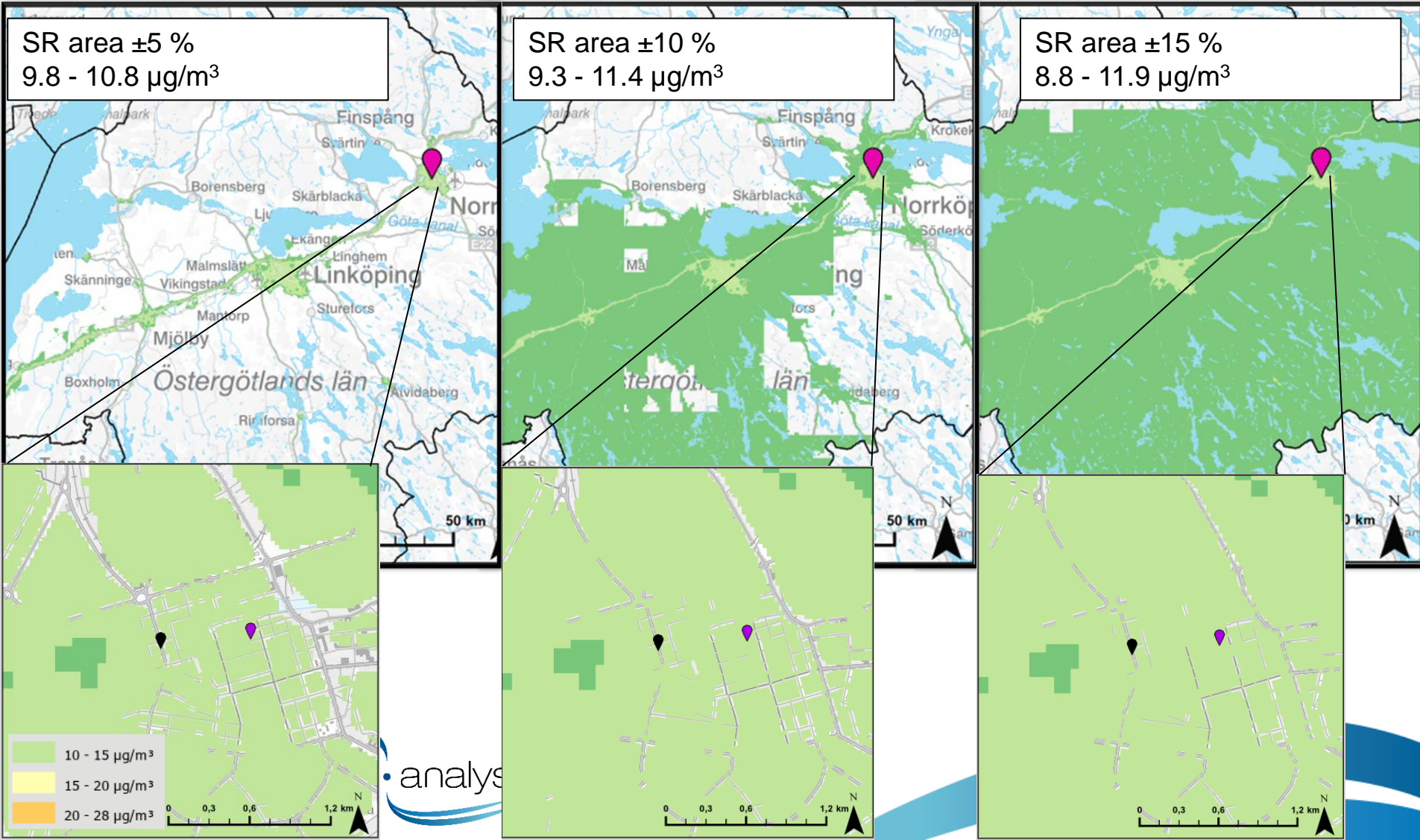
Road links in both Norrköping and Linköping cities included for all thresholds.



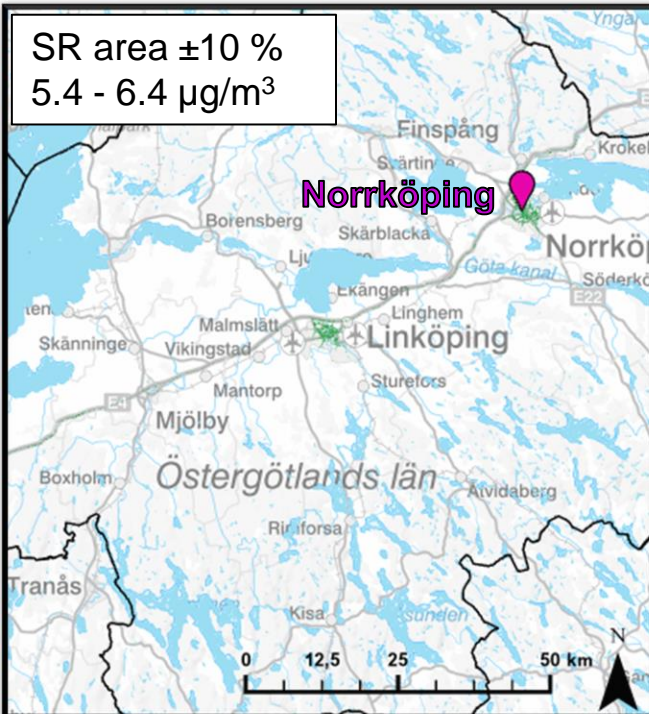
PM10 year urban background

Trädgårdsgatan, Norrköping

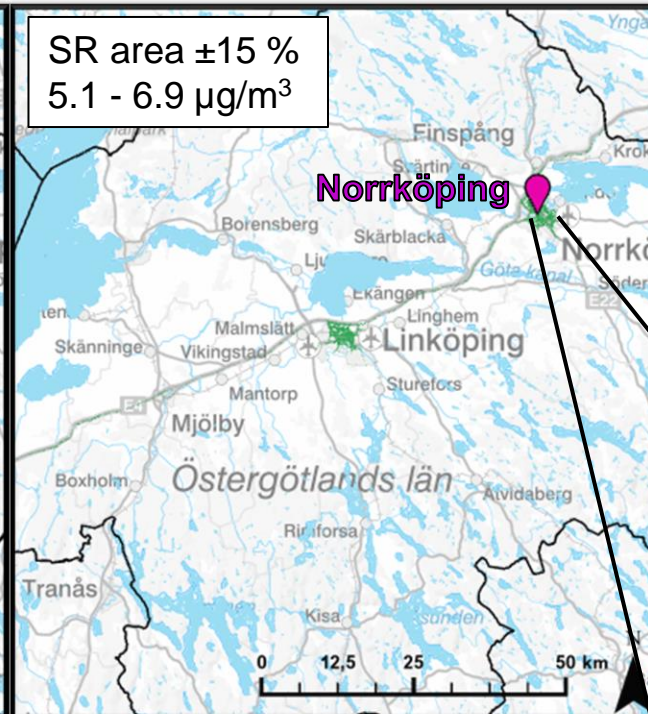
- PM10 model annual mean (2022): 10.3 $\mu\text{g}/\text{m}^3$



SR area $\pm 10\%$
5.4 - 6.4 $\mu\text{g}/\text{m}^3$



SR area $\pm 15\%$
5.1 - 6.9 $\mu\text{g}/\text{m}^3$

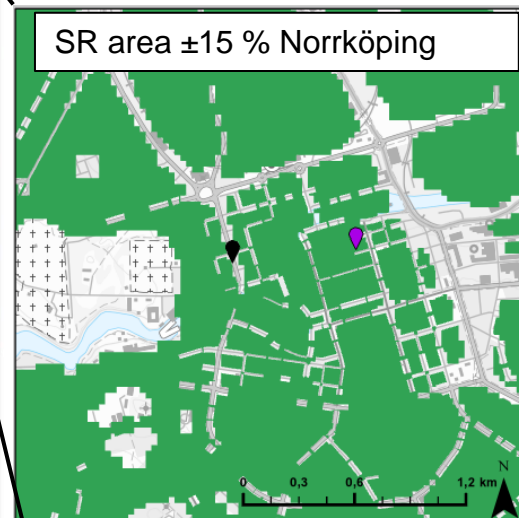


NO₂ year urban background

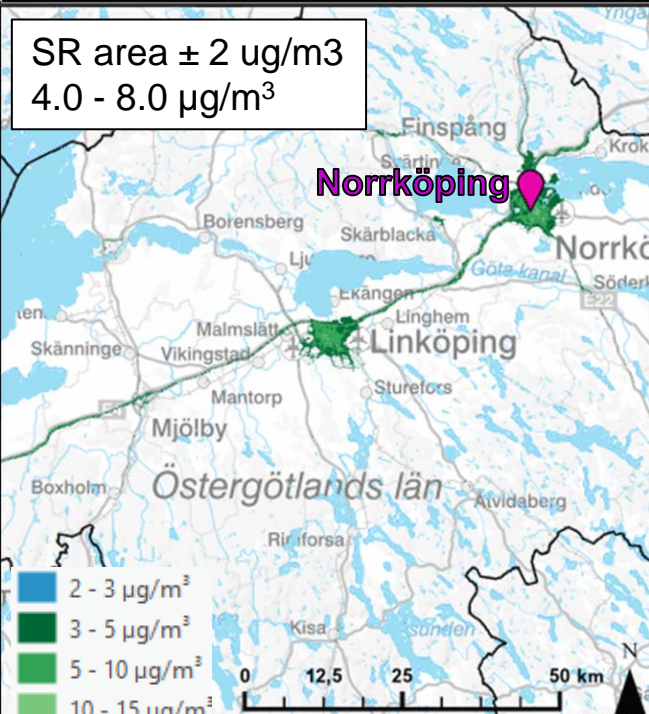
Trädgårdsgatan, Norrköping

- NO₂ model annual mean (2022): 6.0 $\mu\text{g}/\text{m}^3$

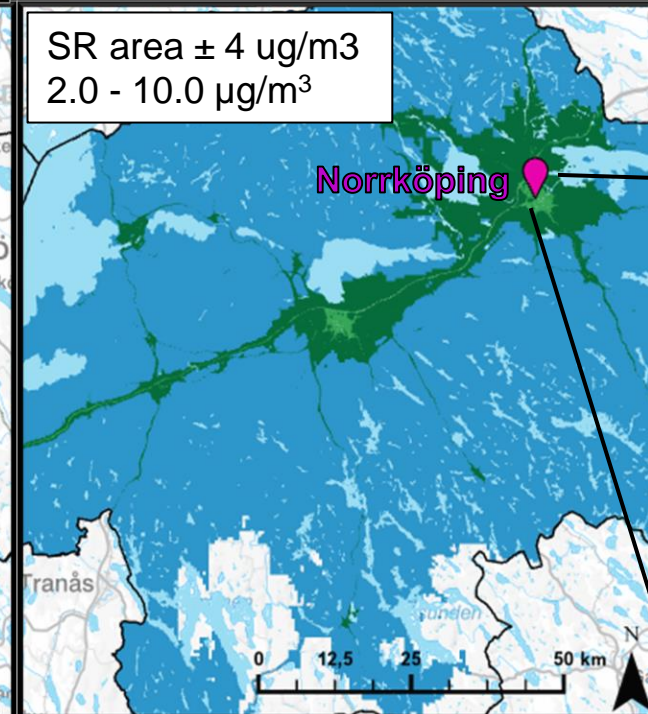
SR area $\pm 15\%$ Norrköping



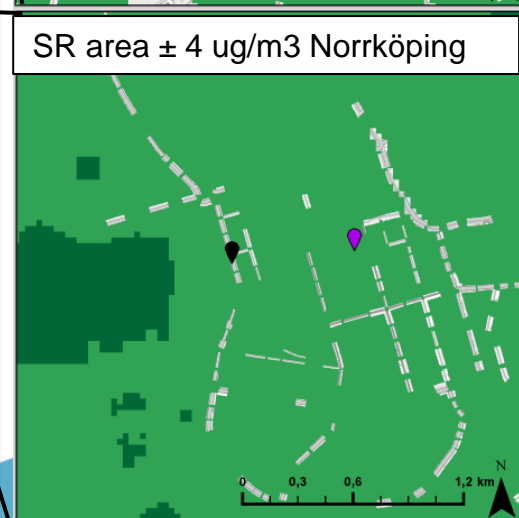
SR area $\pm 2\ \mu\text{g}/\text{m}^3$
4.0 - 8.0 $\mu\text{g}/\text{m}^3$



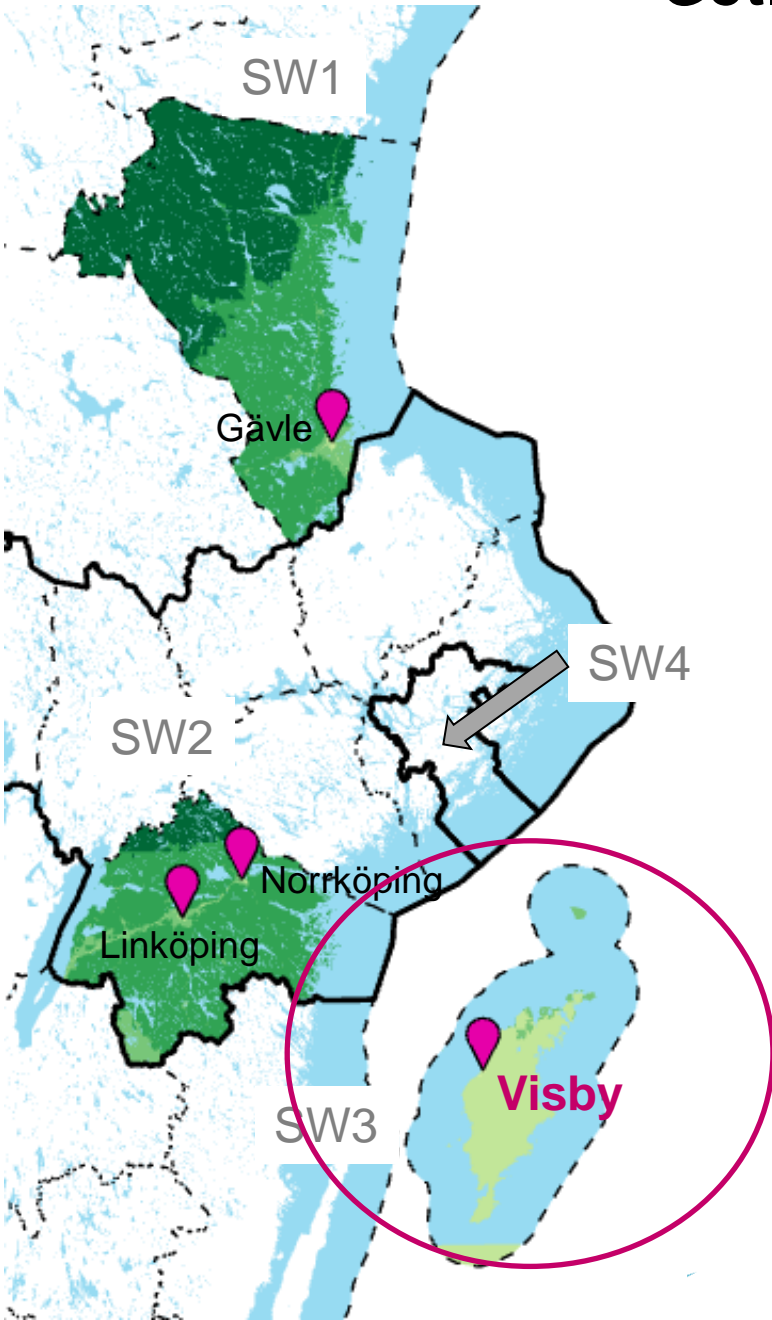
SR area $\pm 4\ \mu\text{g}/\text{m}^3$
2.0 - 10.0 $\mu\text{g}/\text{m}^3$



SR area $\pm 4\ \mu\text{g}/\text{m}^3$ Norrköping



Gotland region - Visby



- Visby, 23 000 inhabitants
The largest town on the island of Gotland

A small town, but Visby exceeds the air quality limit for PM10 (daily 90th percentile) due to limestone being used in pavements and sanding of winter roads together with a large percentage of studded tyres.

Two fixed air quality monitoring sites in Visby:
1 Traffic site
1 Urban background site

PM10 year - traffic site

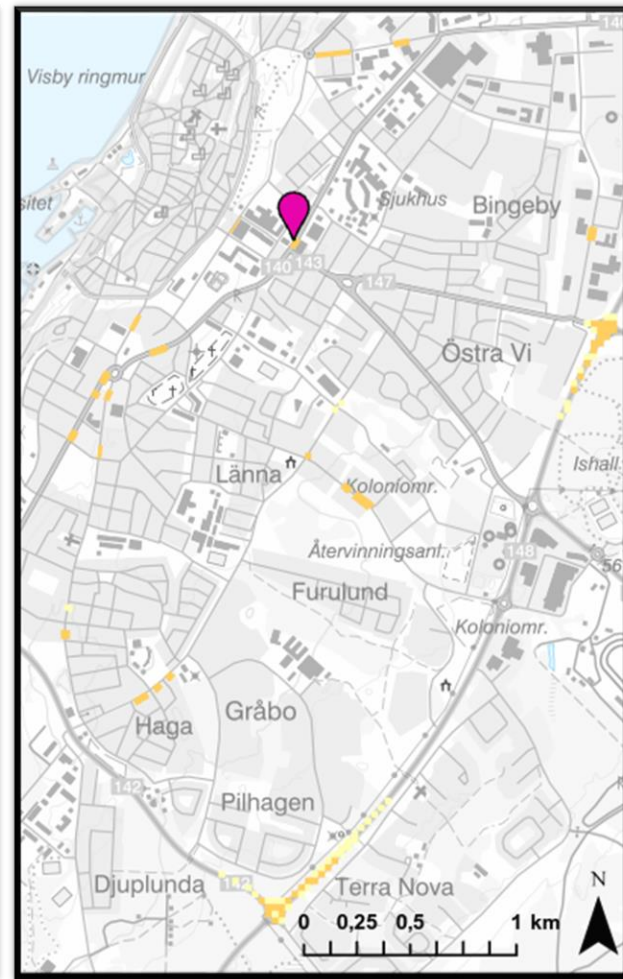
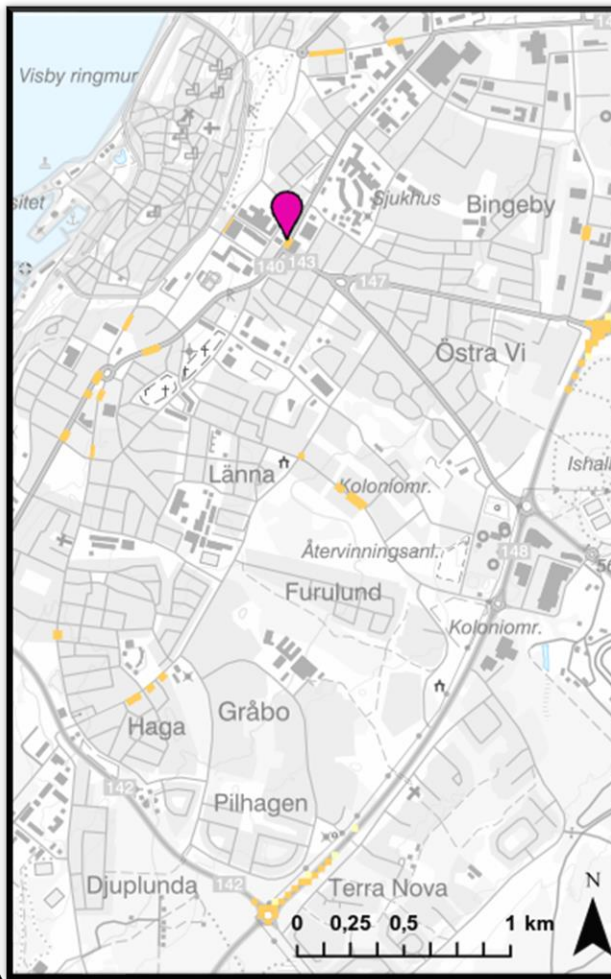
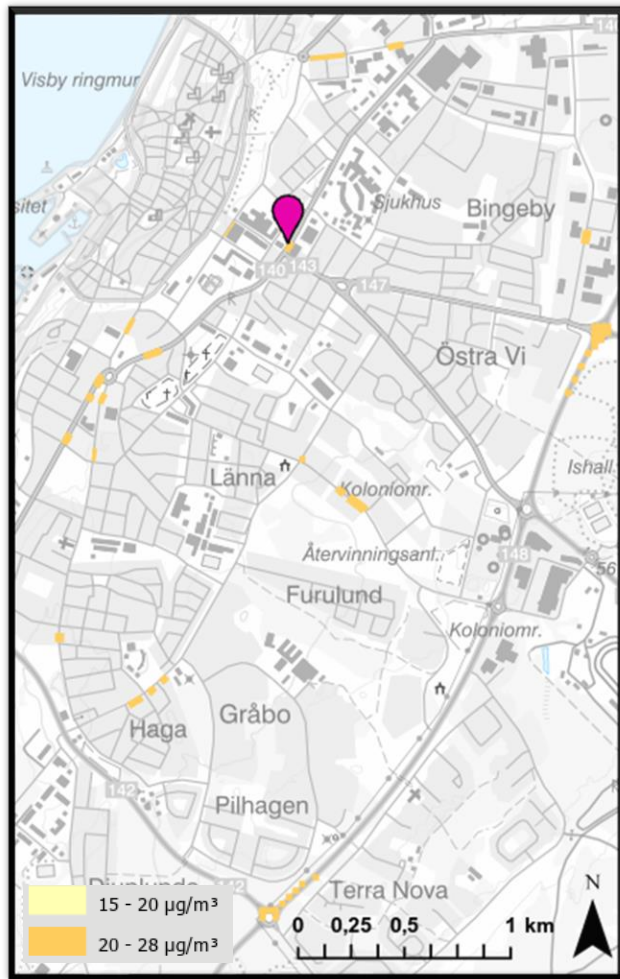
Österväg 17, Visby, Gotland

PM10 model annual mean (2022): 23.8 $\mu\text{g}/\text{m}^3$

Representative area $\pm 15\%$
20.2 – 27.4 $\mu\text{g}/\text{m}^3$

Representative area $\pm 4 \mu\text{g}/\text{m}^3$
19.8 – 27.8 $\mu\text{g}/\text{m}^3$

Representative area $\pm 20\%$
19.0 – 28.5 $\mu\text{g}/\text{m}^3$

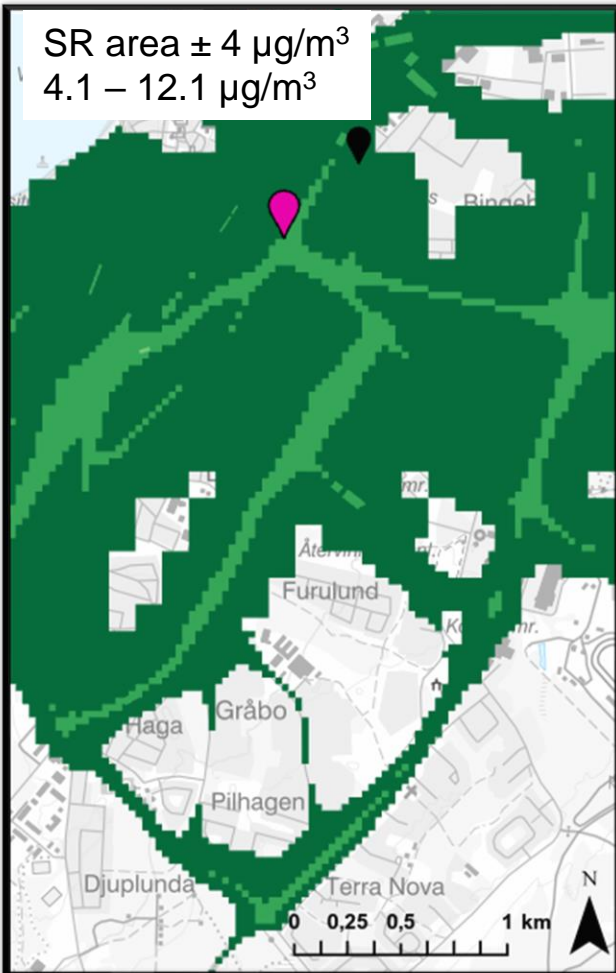
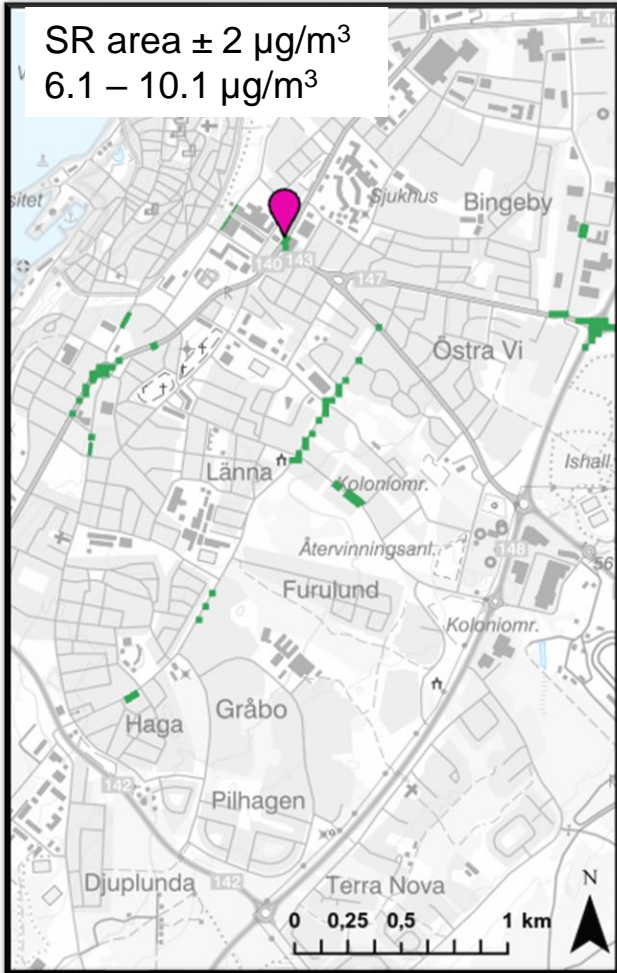
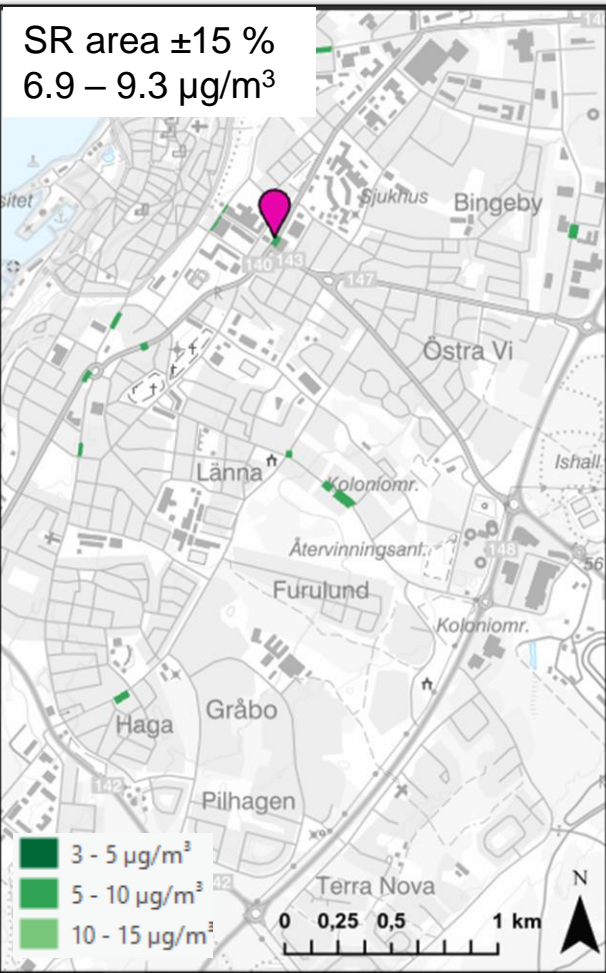


SR area only includes road links in Visby + one single road link in the small town Hemse

NO₂ year - traffic site

Österväg 17, Visby, Gotland

NO₂ model annual mean (2022): 8.1 µg/m³

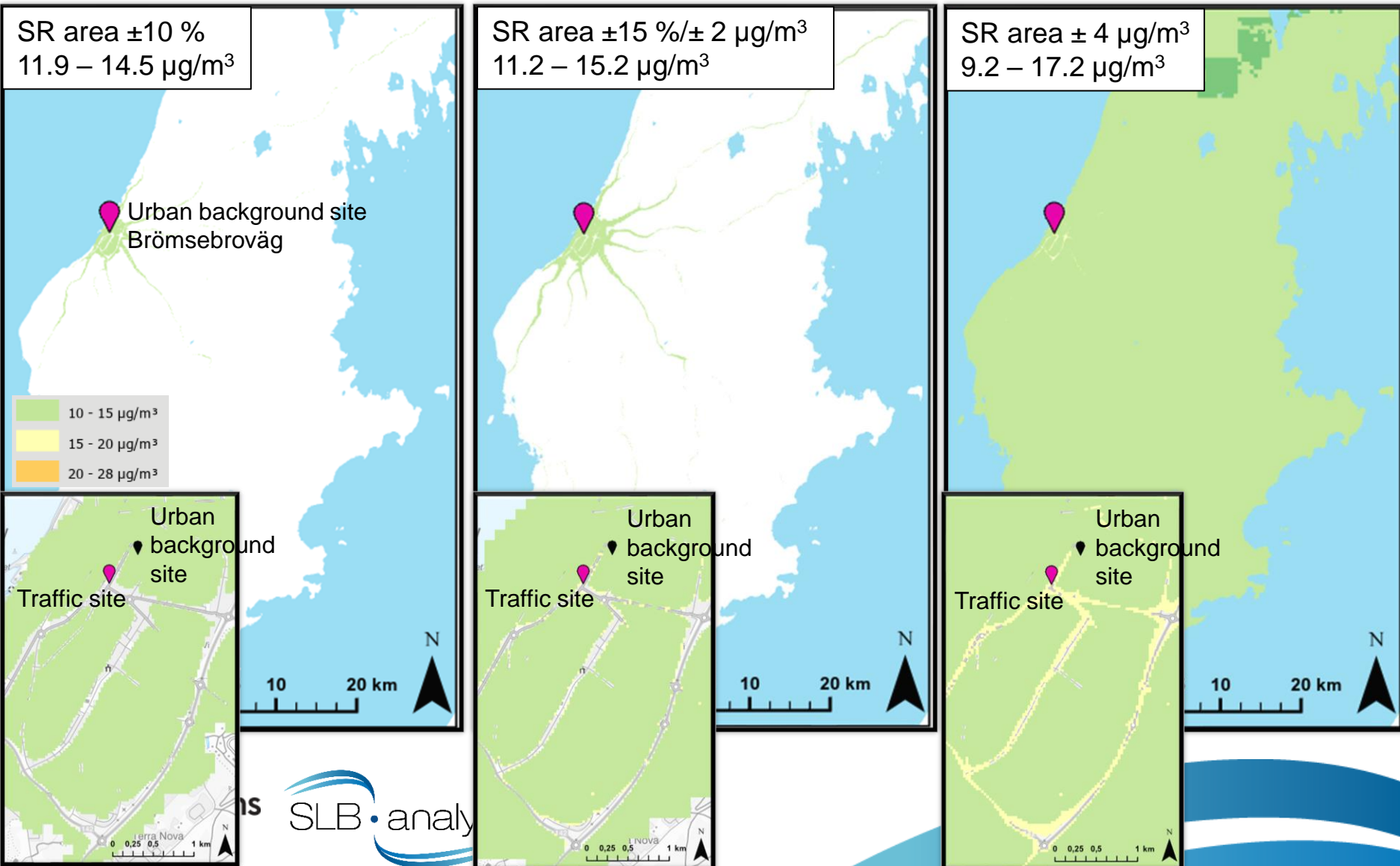


SR area includes links in Visby + industrial area in the east of the island

PM10 year urban background

Brömsebroväg, Visby, Gotland

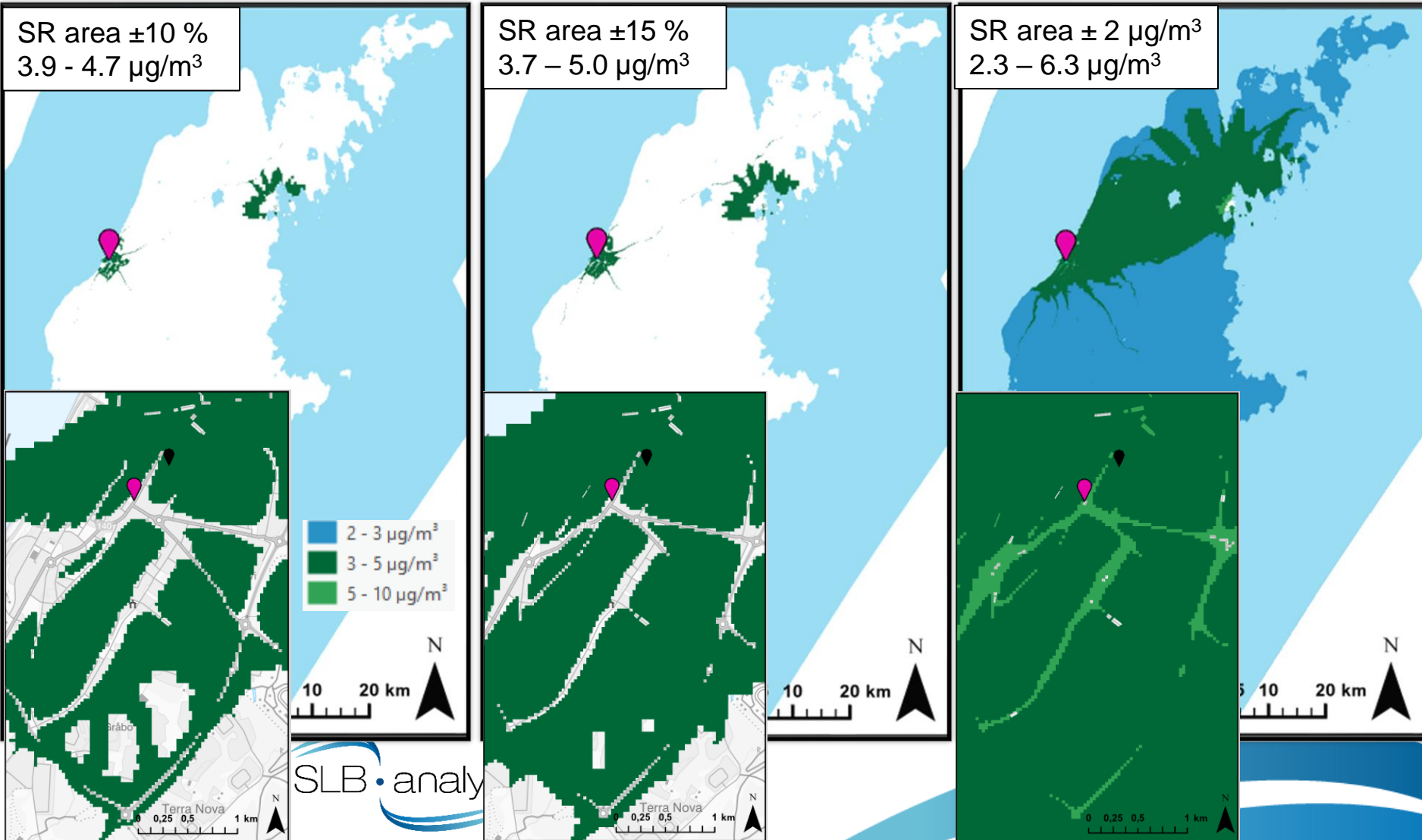
- PM10 model annual mean (2022): 13.2 $\mu\text{g}/\text{m}^3$



NO₂ year urban background

Brömsebroväg, Visby, Gotland

- NO₂ model annual mean (2022): 4.3 µg/m³



Reflections

- $\pm 15\%$ or $\pm 20\%$ can work for traffic stations within cities - but highways and/or other cities/municipalities often included in the SR area
- Perhaps a need for further criterias?
 - Limit to within city for urban stations?
Road type? (street canyon, motorways, etc.) Area type? (city, industrial, rural).
 - Zone-based limits not so useful in Sweden
- A lower percentage more appropriate for background stations
- Cut offs values problematic, especially for background stations, since the difference between regional and urban background levels can be small in Sweden
- SR area similar for annual mean and percentiles, BUT daily mean is calculated using empirical formulas and not time series modeling