

Stockholm pilot

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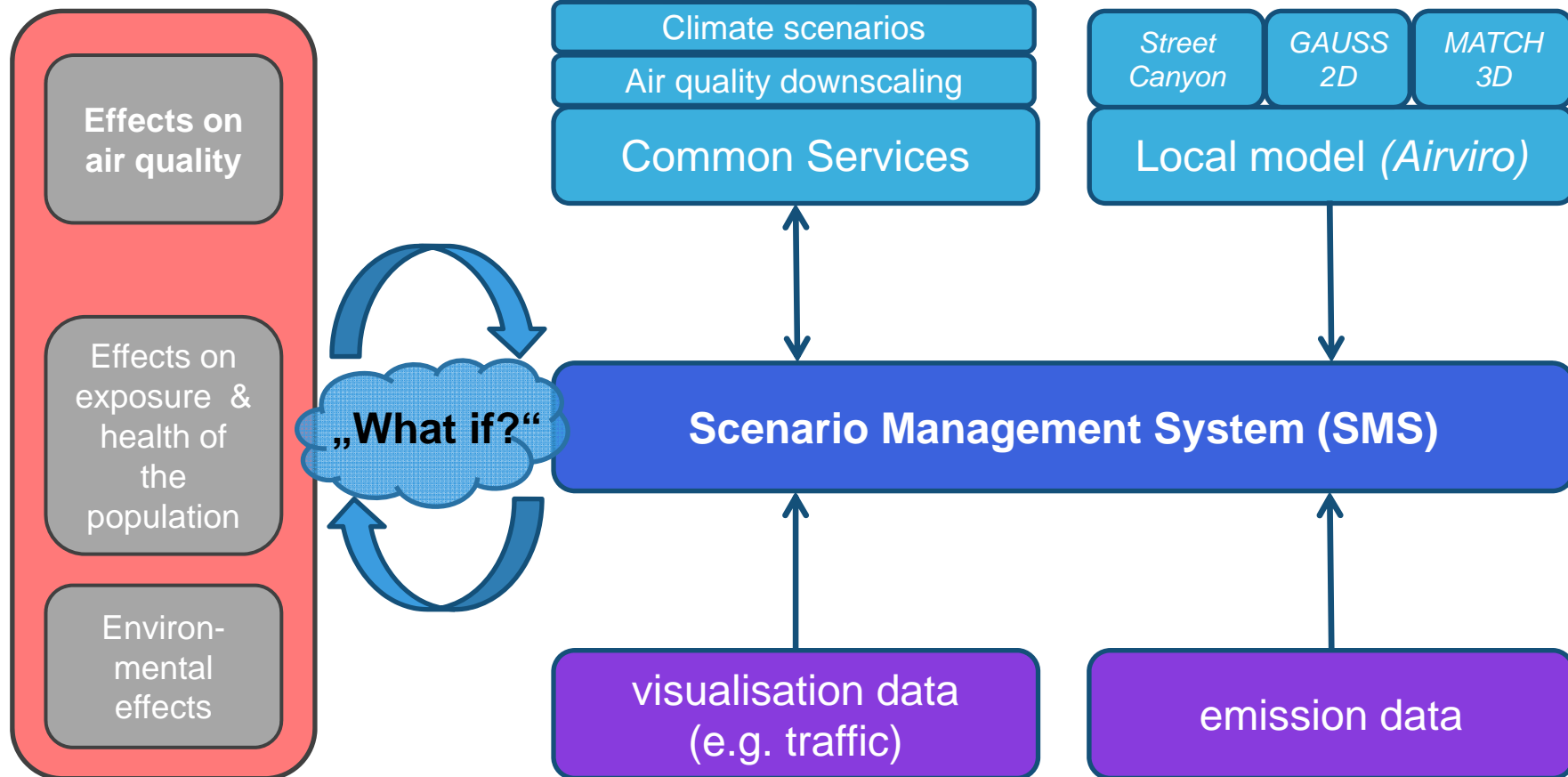
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Urban Planning: Comparison of traffic solutions

- Connect north and south
- Provide efficient ways to pass the city
- Increase possibility for creating new residential areas and commercial centers

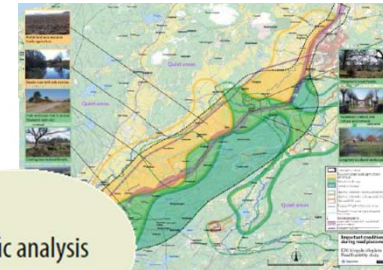
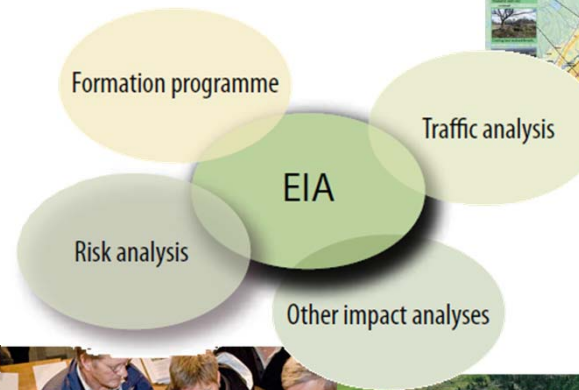
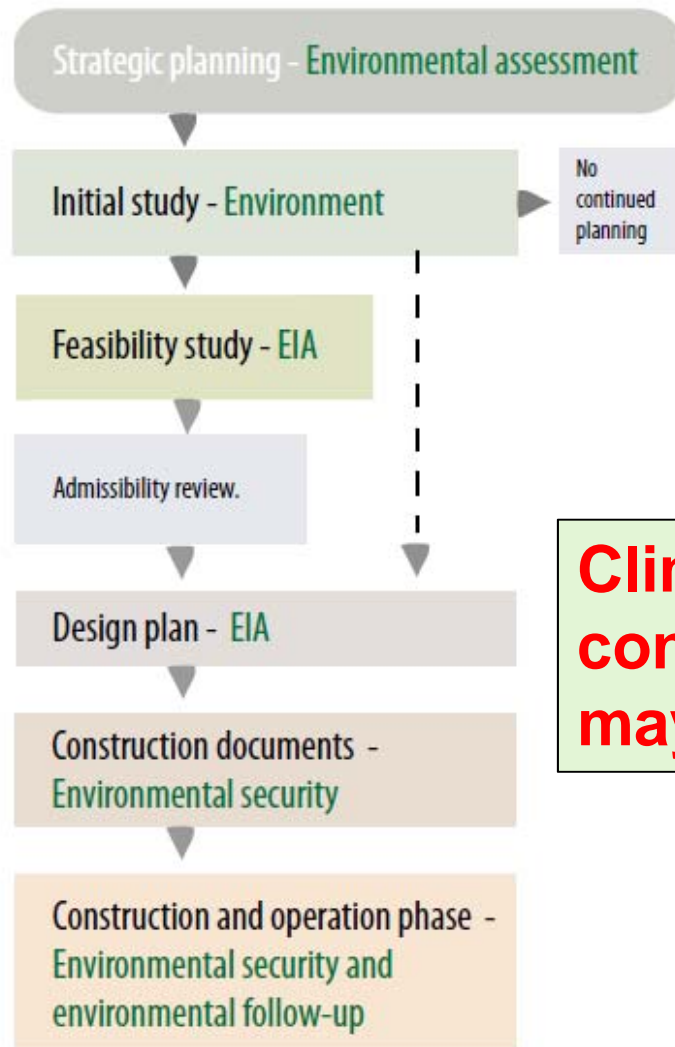


Issues and the tool to manage them

SUDPLAN is used to assess impact on local air quality of:

- 1. The climate change scenarios**
- 2. Future European emissions**

Environmental Impact Assessment in urban planning



Landscape characters



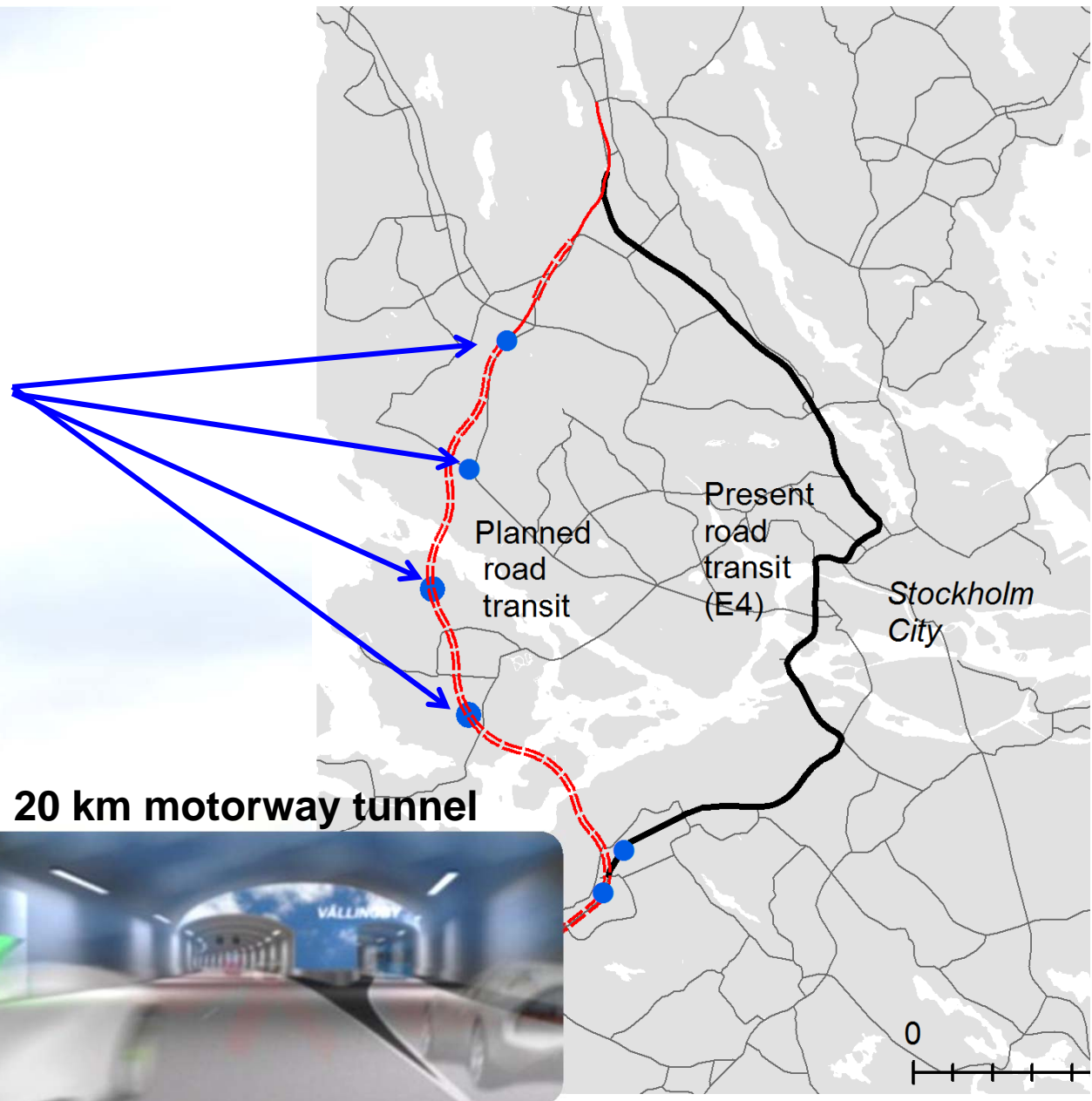
Climate change normally not considered in urban planning but may be important!



Alternative urban scenarios

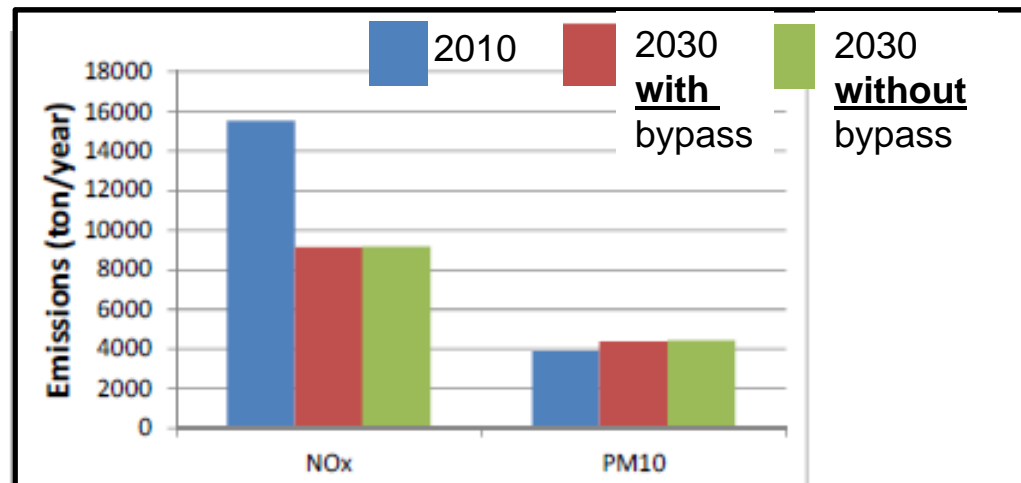
SUDPLAN

**6 ventilation towers
for tunnel air**

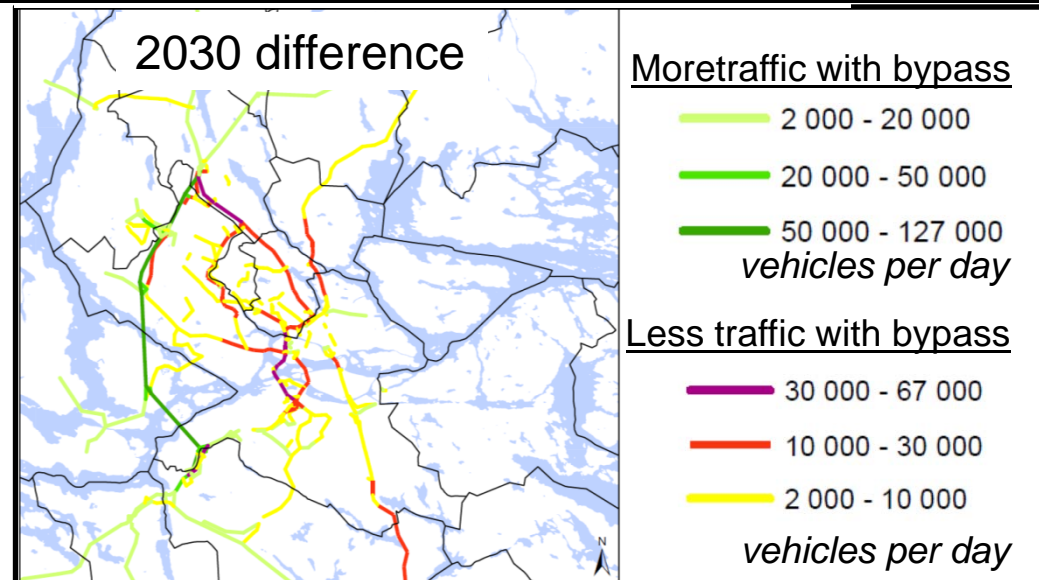


Effects on traffic and emissions

- Emissions decrease from 2010 to 2030
- Similar emissions with and without the motorway bypass



- **BUT** emissions are distributed from city center to ventilation towers outside the city

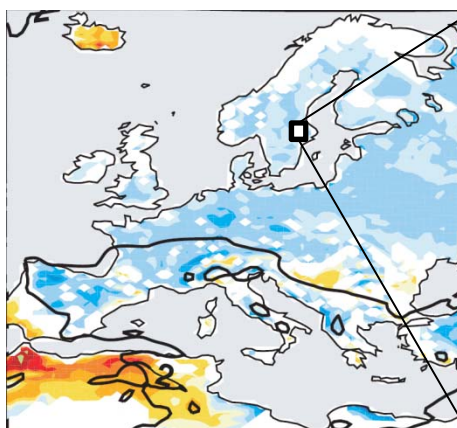


Climate change and European emissions



- Two global climate models
- Global RCP4.5 emissions

SUDPLAN Common service



- Regional climate
- European emissions
- Chemical transport model
50 km x 50 km

102x102 km. 2
km resolution

36x30 km. 1 km
resolution for
assessing
population
exposure

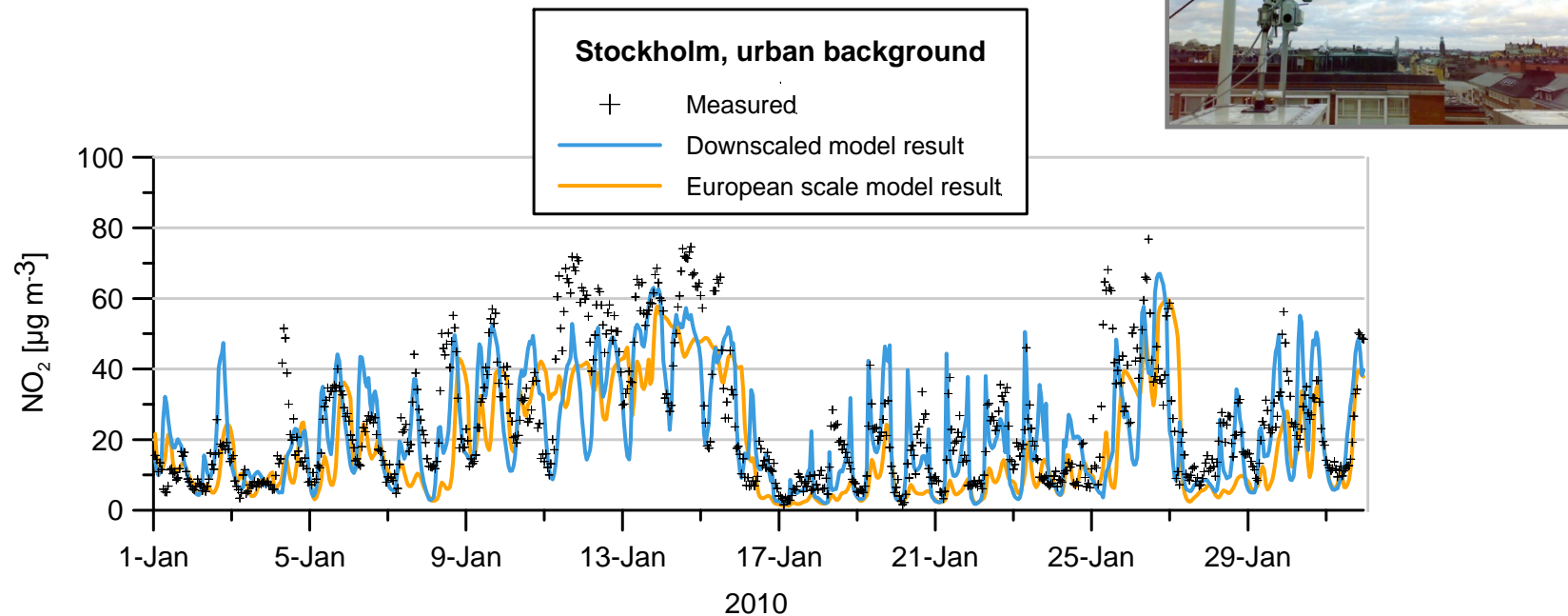
Population

< 20
20 - 65
66 - 140
141 - 245
246 - 380
380 - 600
601 - 1000
1000 - 2500



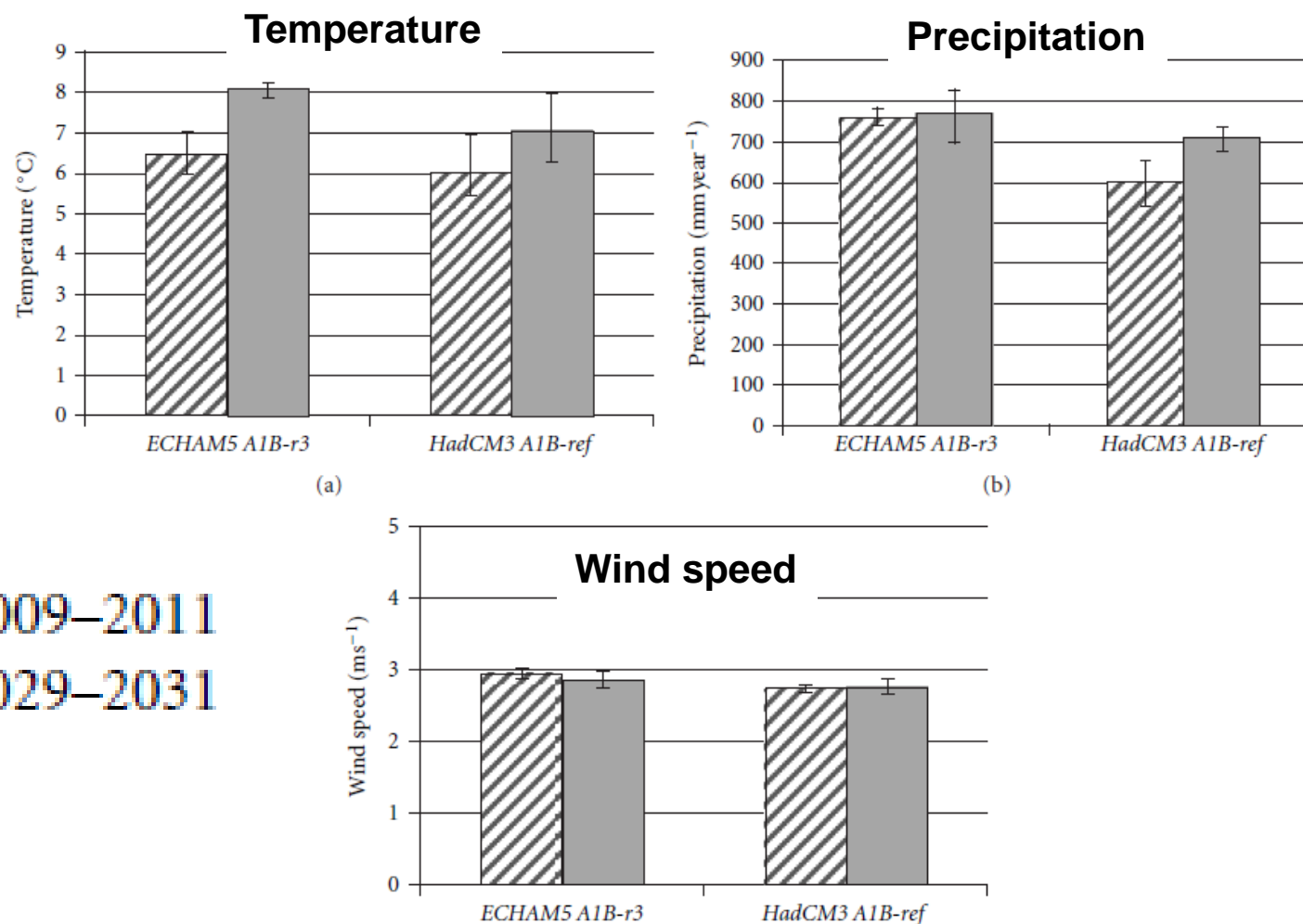
0 10 20 30 40 50 km

Evaluation of Air Quality modelling



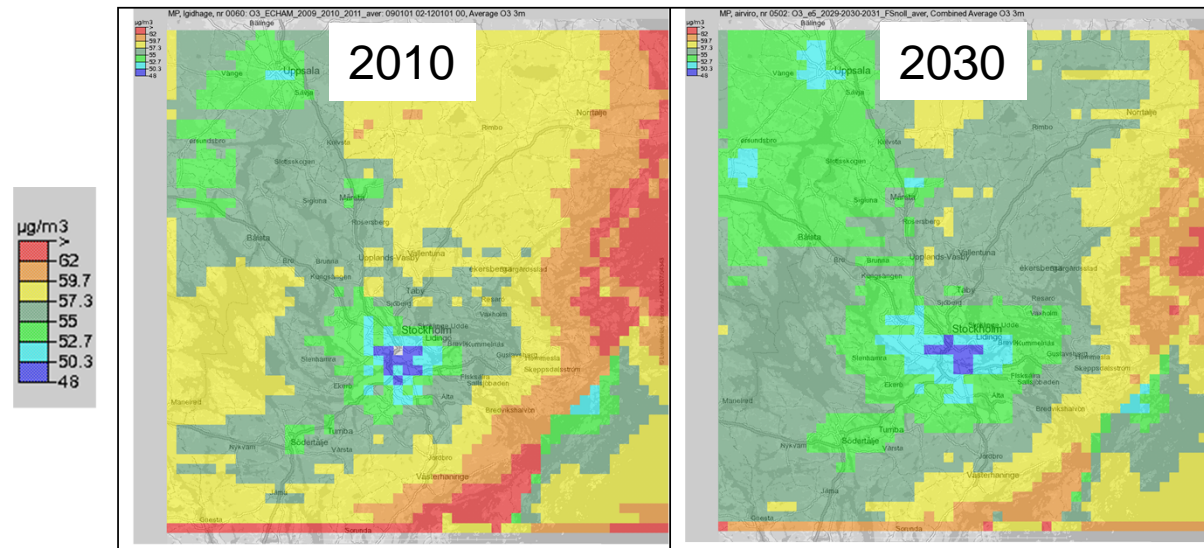
- The validation results for this time period are generally good.
- The hourly and daily variability of NO₂ is captured well, especially by the downscaled model.

Warmer and wetter 2030 compared to 2010

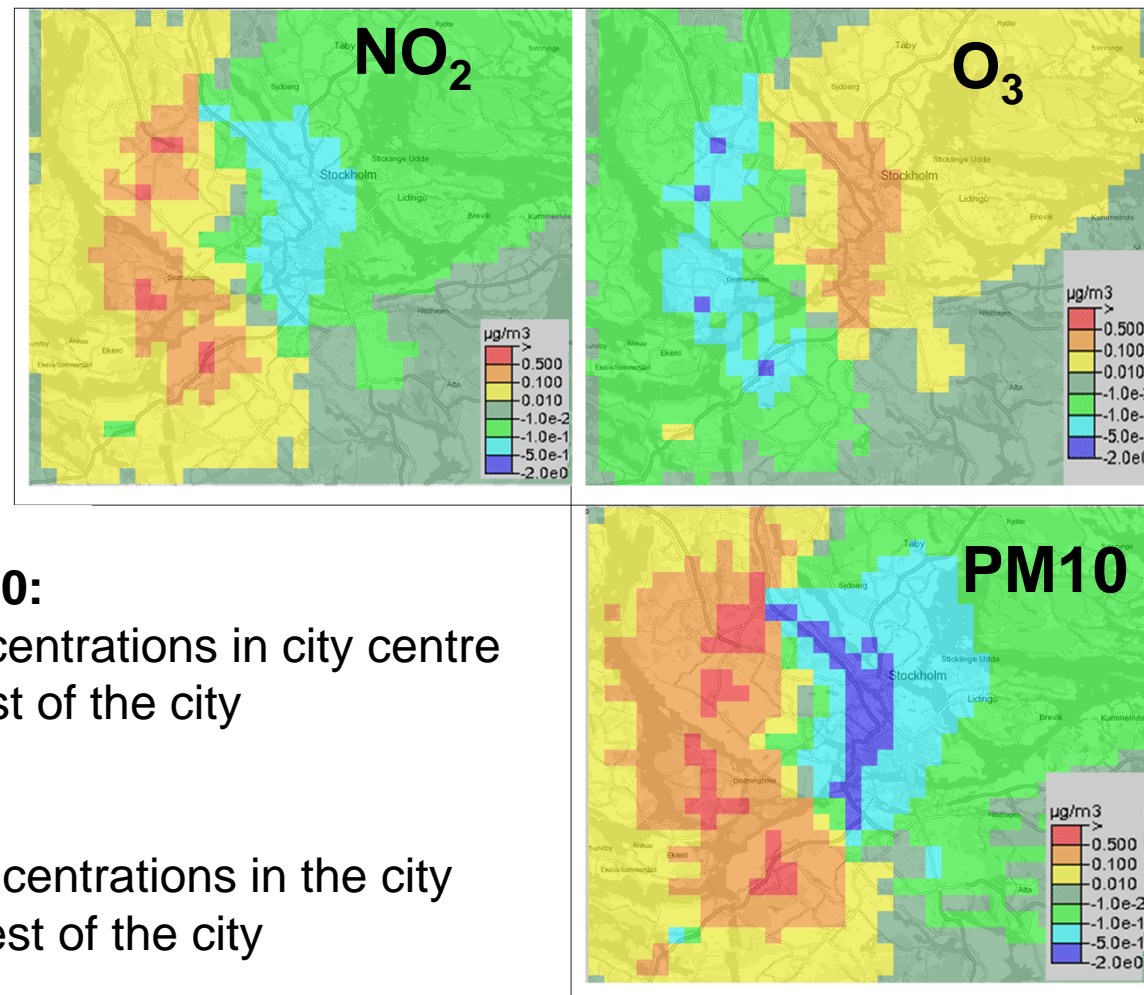


Air Quality improves even without bypass

Ozone
(O₃)

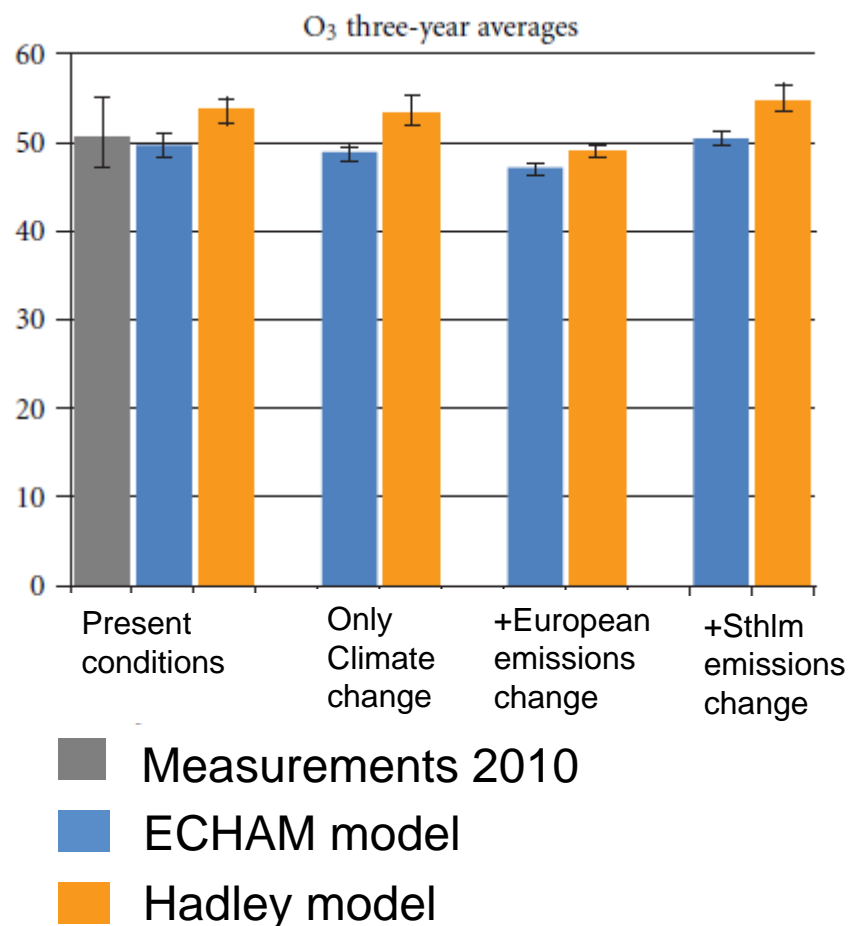


Difference with & without bypass



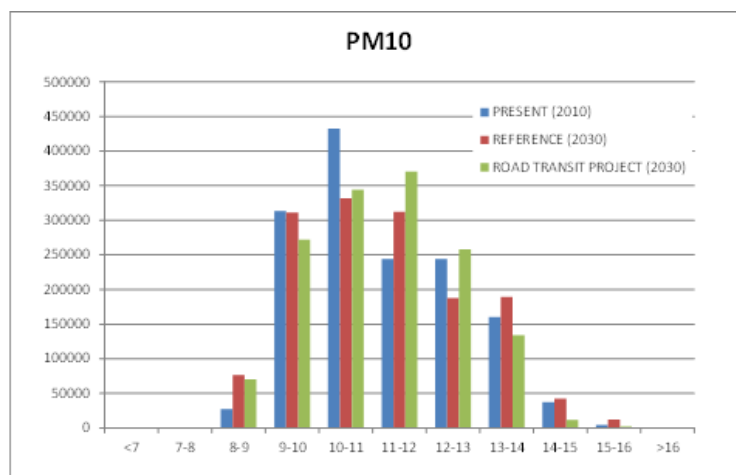
Ozone concentrations in the city center

- **Small effect of only climate change**
- **Lower concentrations due to European emissions**
- **Slight increase in the city center due to less traffic emissions**
- **Future emissions is the most important factor for air quality**

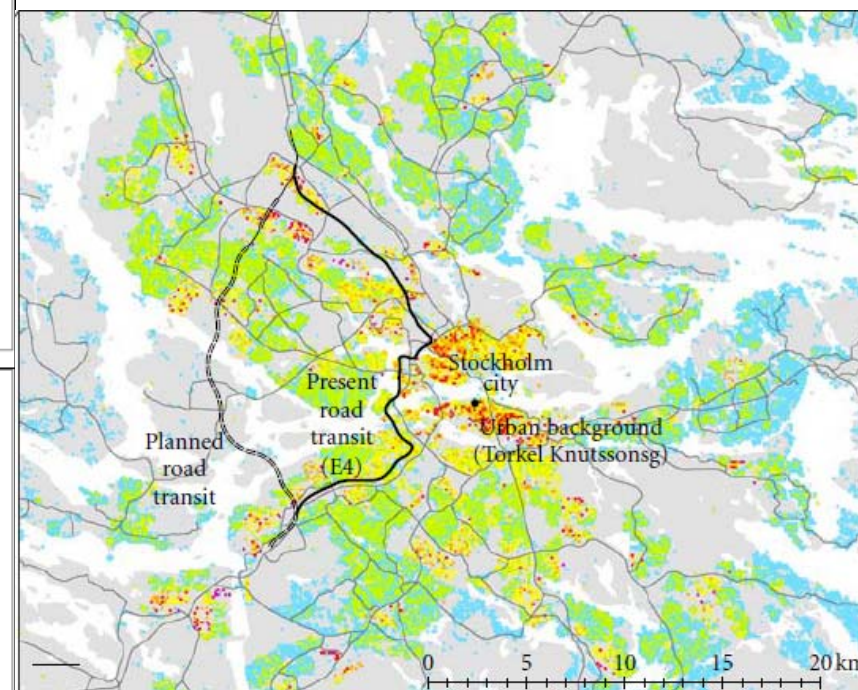
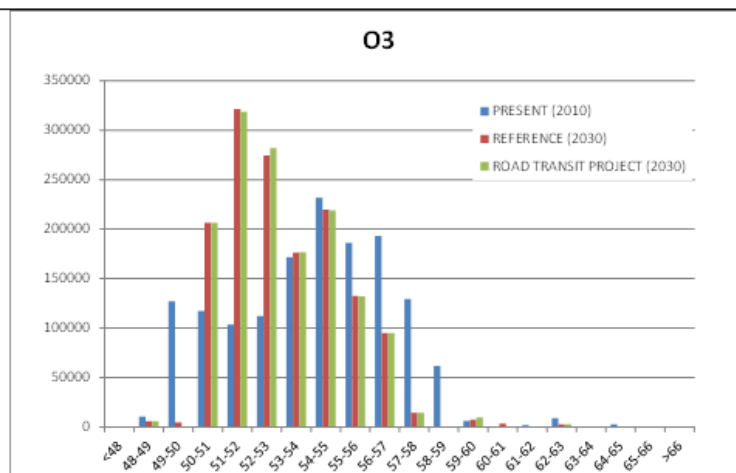


Population exposure with & without bypass

PRESENT: 11.18
REFERENCE: 11.18
ROAD PROJECT: 11.13

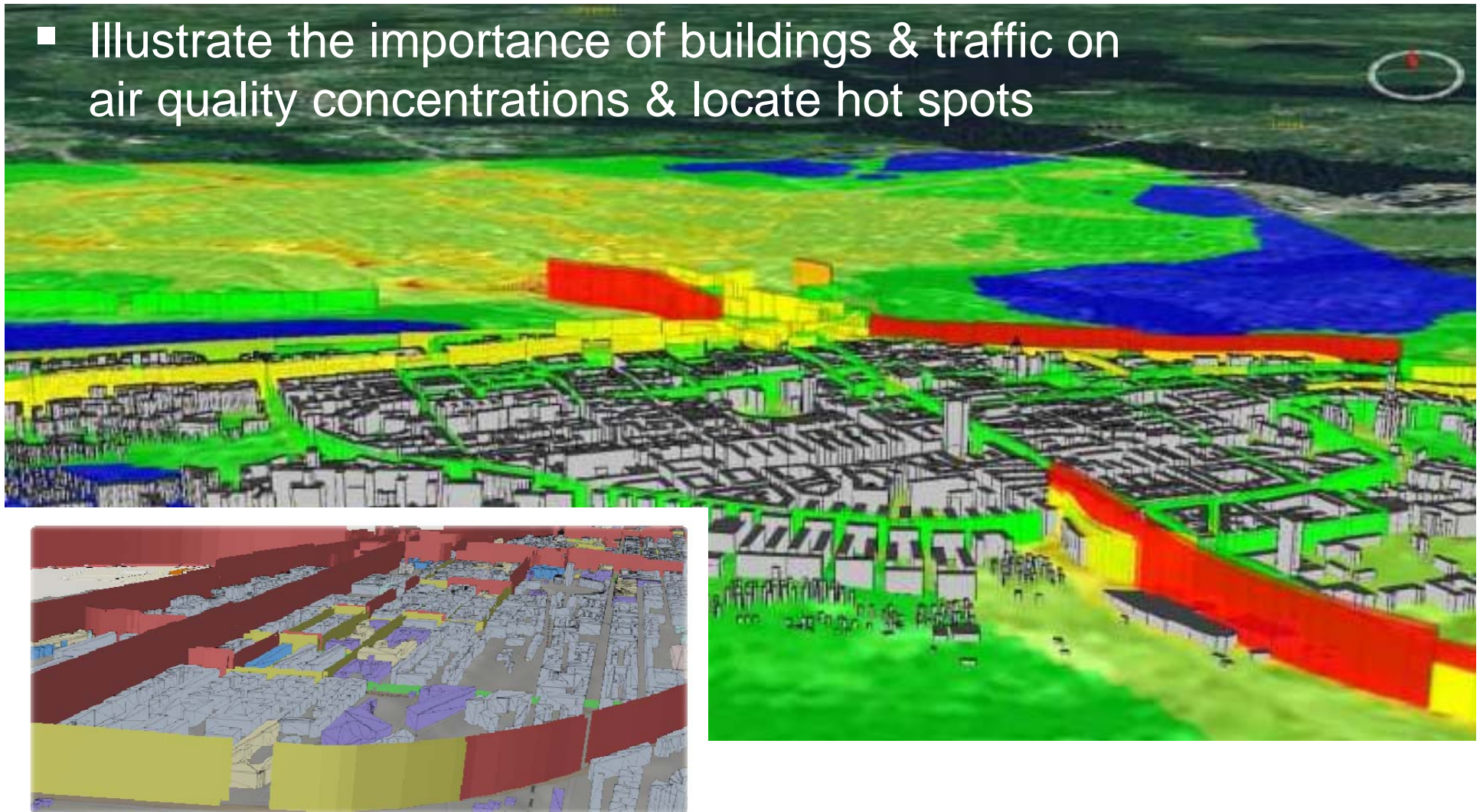


PRESENT: 54.13
REFERENCE: 53.05
ROAD PROJECT: 53.06



3D visualisation

- Illustrate the importance of buildings & traffic on air quality concentrations & locate hot spots



Conclusions

- **Evolution of climate and air quality (NO₂, ozone and PM) for two different climate scenarios has been analysed in a road planning project in Stockholm**
- **Air quality downscaling has shown satisfactory results when compared with monitoring data**
- **The effect of climate change on NO₂ and ozone is small in Stockholm 2030**
- **The change in emissions is the most important for future air quality**
- **SUDPLAN has provided the effects of climate change and changing European emissions**

Thank you for your attention!

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Research Article

Modeling Effects of Climate Change on Air Quality and Population Exposure in Urban Planning Scenarios

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We employ a nested system of global and regional climate models, linked to regional and urban air quality chemical transport models utilizing detailed inventories of present and future emissions, to study the relative impact of climate change and changing air pollutant emissions on air quality and population exposure in Stockholm, Sweden. We show that climate change only marginally affects air quality over the 20-year period studied. An exposure assessment reveals that the population of Stockholm can expect considerably lower NO₂ exposure in the future, mainly due to reduced local NO_x emissions. Ozone exposure will decrease only slightly, due to a combination of increased concentrations in the city centre and decreasing concentrations in the suburban areas. The increase in ozone concentration is a consequence of decreased local NO_x emissions, which reduces the titration of the long-range transported ozone. Finally, we evaluate the consequences of a planned road transit project on future air quality in Stockholm. The construction of a very large bypass road (including one of the largest motorway road tunnels in Europe) will only marginally influence total population exposure, this since the improved air quality in the city centre will be complemented by deteriorated air quality in suburban, residential areas.

