Traffic emissions of PM10 and NO_x in Stockholm

– a comparison between bottom-up and top-down data

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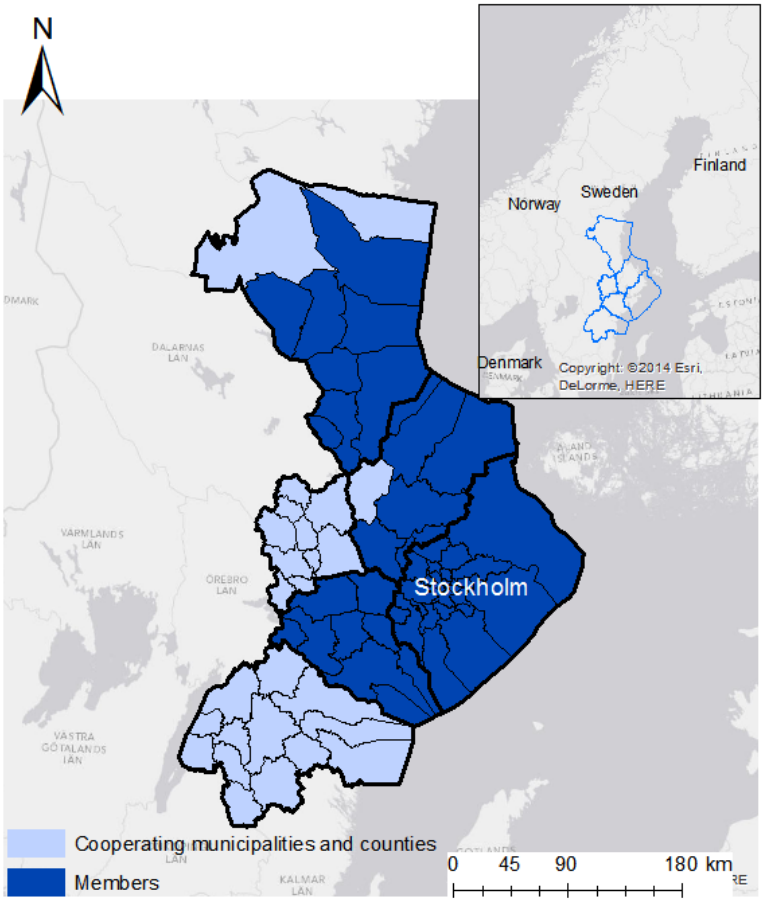
Coordination of air quality monitoring

Air quality monitoring in **Stockholm** but also **surrounding counties**

Eastern Sweden's Air Quality Management Association

- Founded in 1992
- 4 counties
- 50 municipalities
- ~ 3 million inhabitants (>30 % of total population in Sweden)
- Institutes, companies and government agencies



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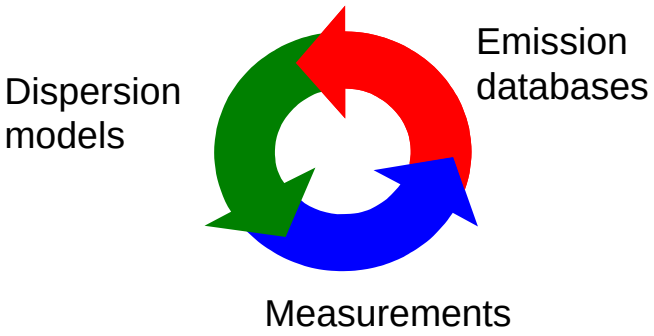
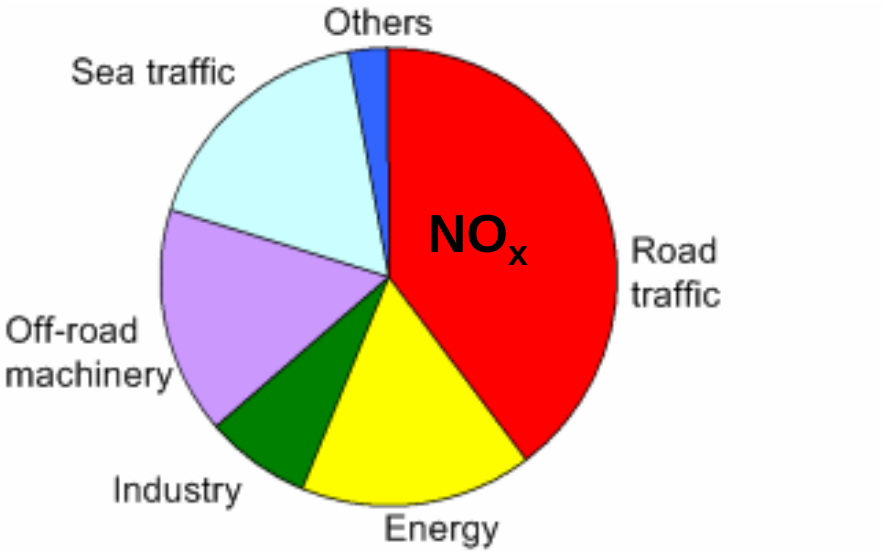
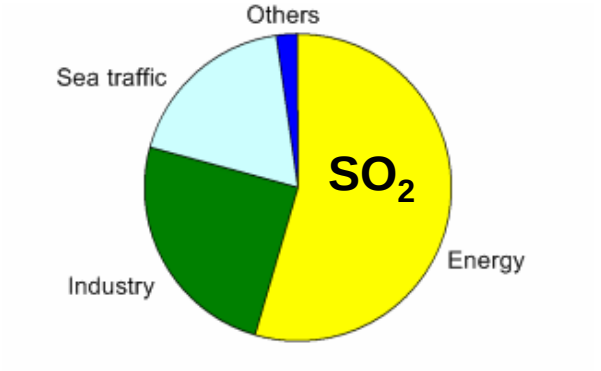
The main purpose and use of our emission databases…

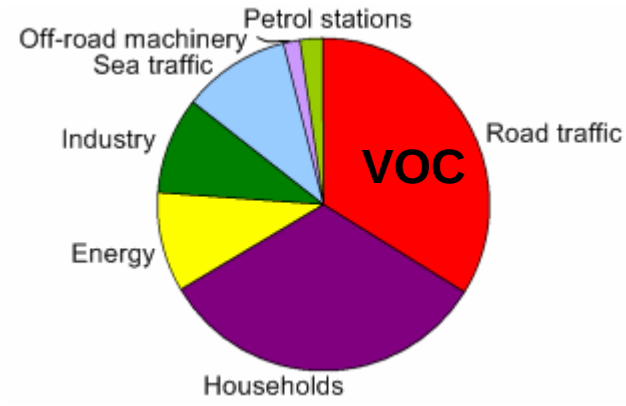
- …is to provide input data for modeling
  - to survey the air quality in the current situation (supplement to measurements)
  - future projections at the development of new residential areas, roads, tunnels, etc.
  - analyze various measures to improve air quality
  - calculate the exposure of various air pollutants/ epidemiological studies (time series calculations backwards in time)
- …not reporting emission data and emission trends

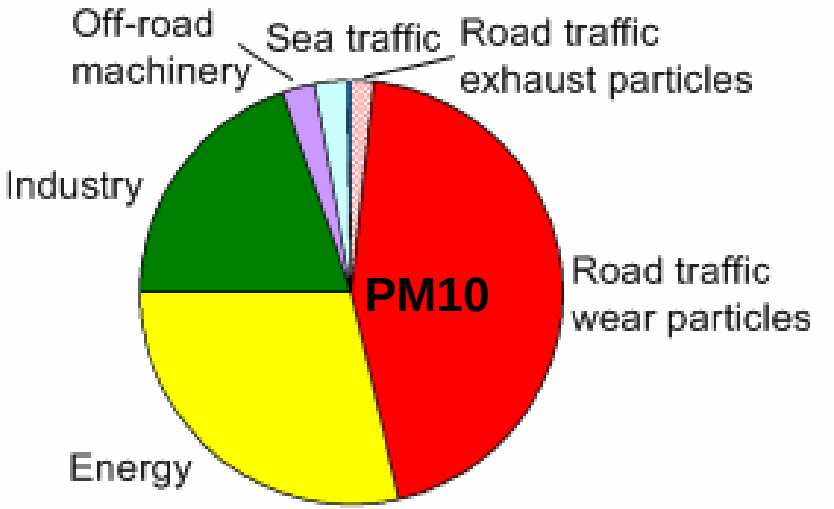


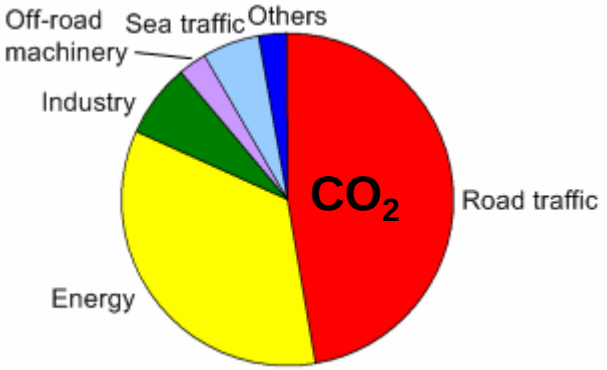
Local emissions in Stockholm County











Road traffic emissions

Pneumatic road tube counters

- Road network, signed speed,
  - **National Road Data Base** (traffic flow, signed speed, road type..)
  - **Traffic measurements and models** (traffic flow, real speed, heavy traffic share

Microwave detectors Video cameras

- Emission models
  - Exhaust emissions: **HBEFA 3.2**
  - Emissions and resuspension of road dust: **Nortrip**

NORTRIP

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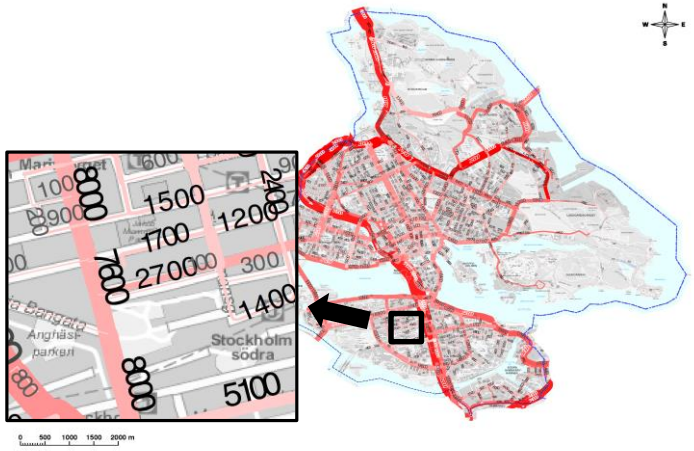
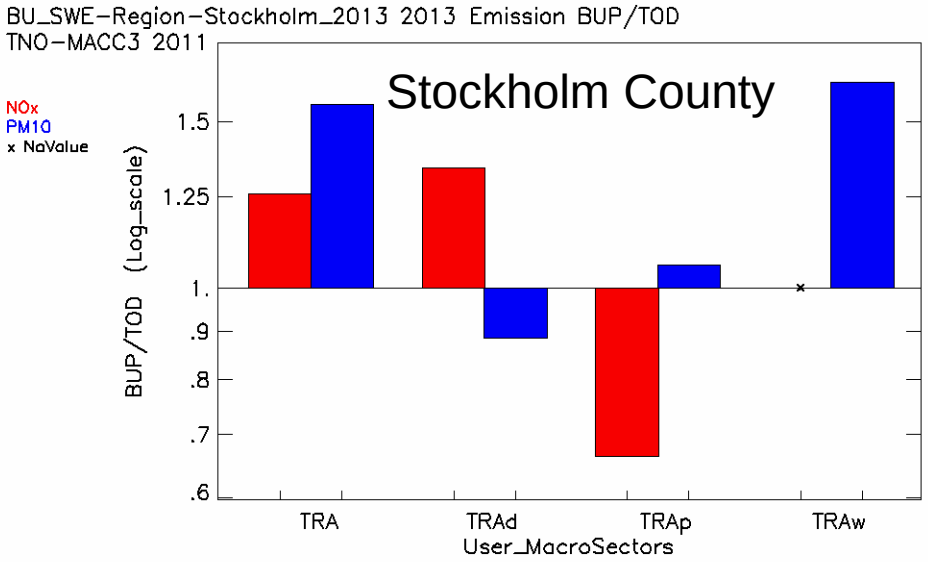
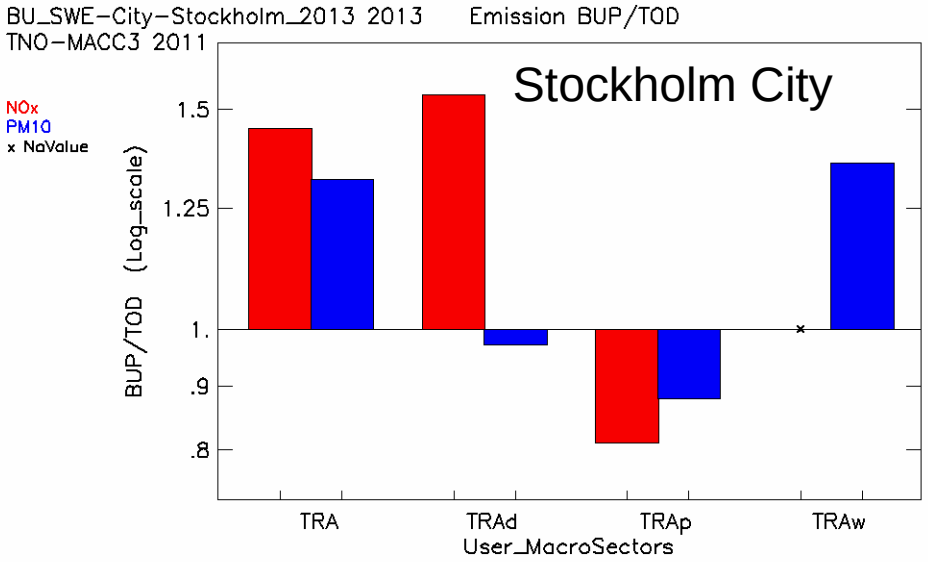


Non-exhaust emission model NORTRIP

Denby et al 2013. A coupled road dust and surface moisture model to predict non-exhaust road traffic induced particle emissions (NORTRIP). Part 1: Road dust loading and suspension modelling.

TOD vs BUP Traffic emissions





- PM10
  - BUP higher emissions of wear-particles

← **Studded tyres**

- NOx
  - BUP higher emissions from diesel vehicles
  - BUP lower emissions from gasoline vehicles

← **Vehicle distribution between diesel and gasoline**

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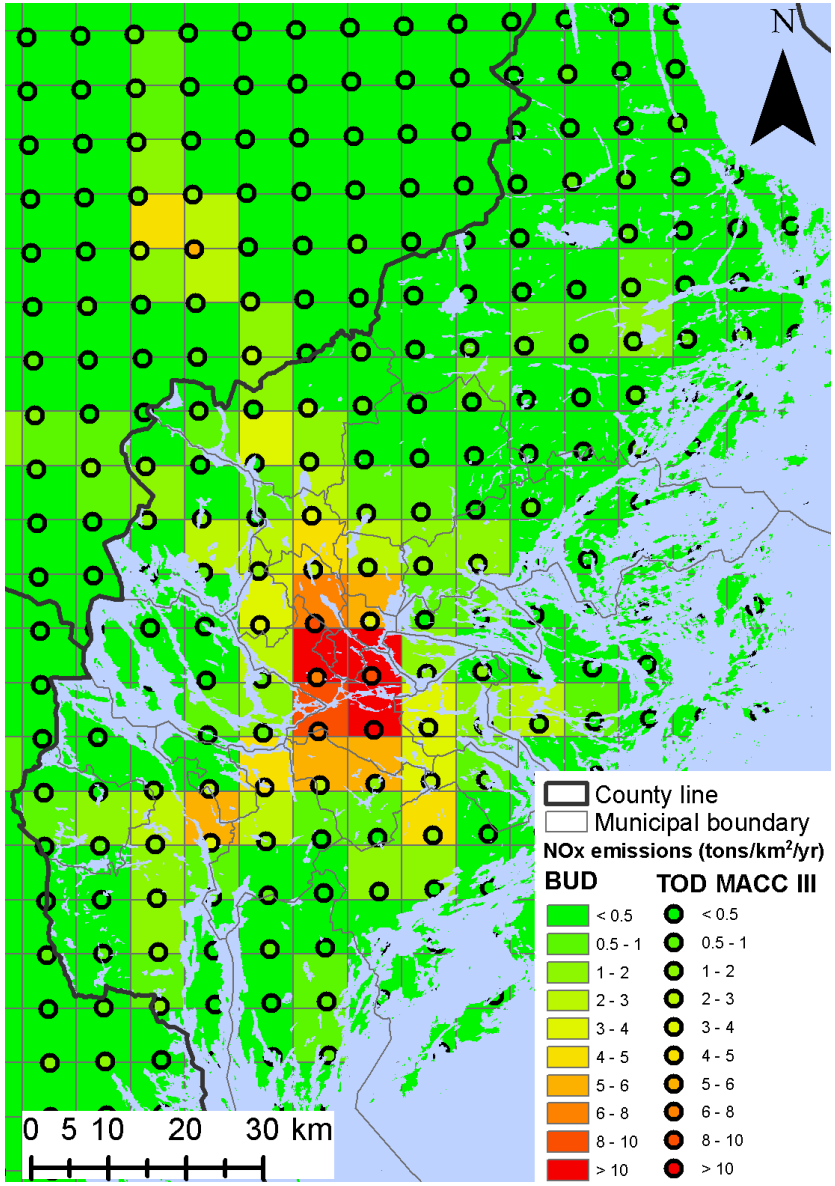
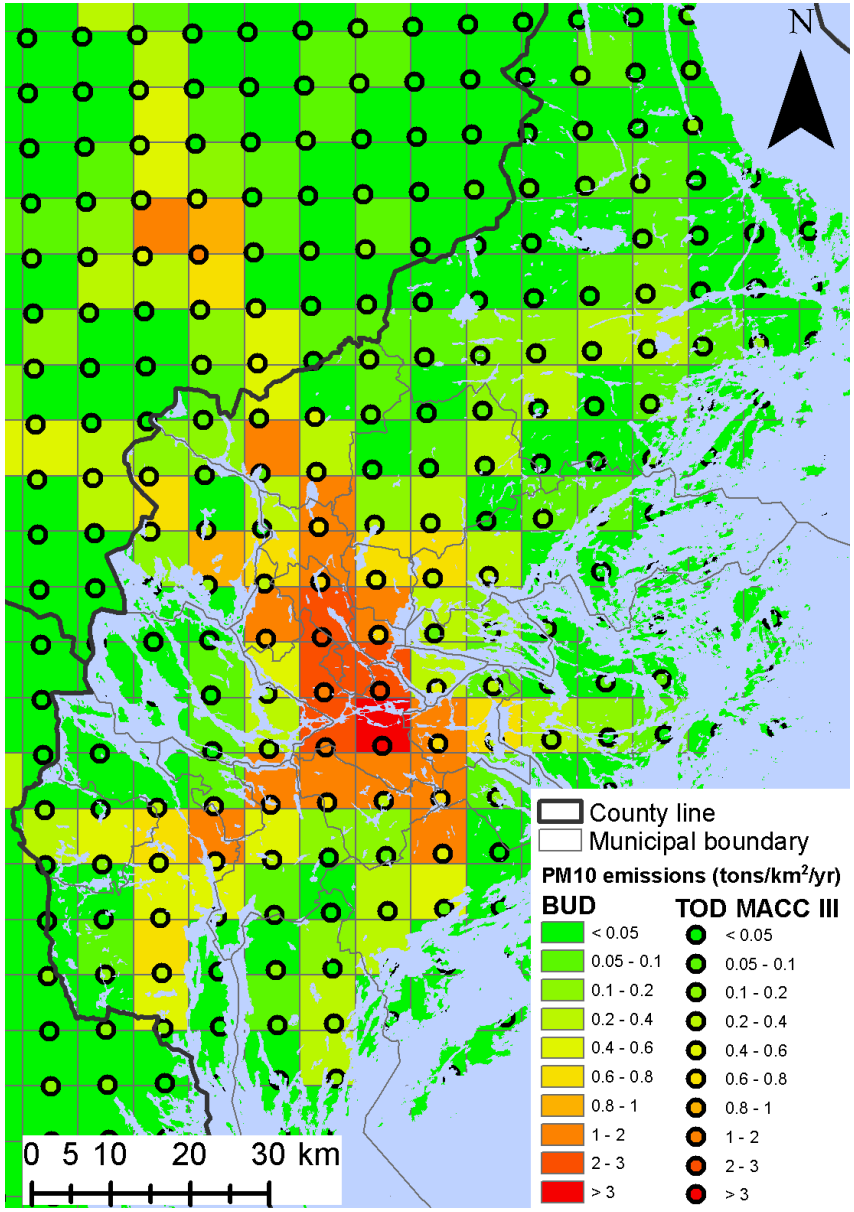
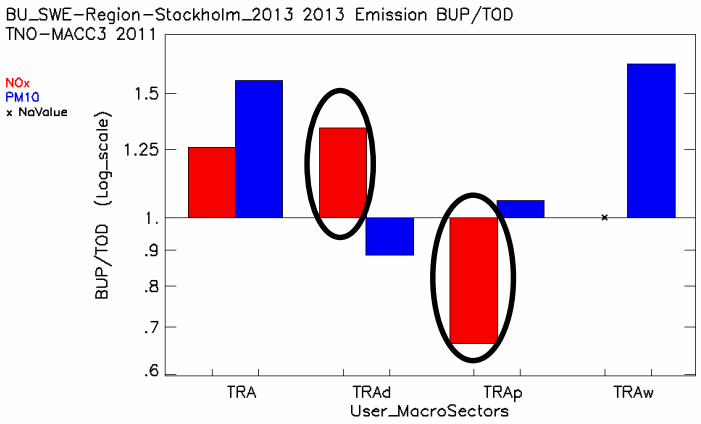
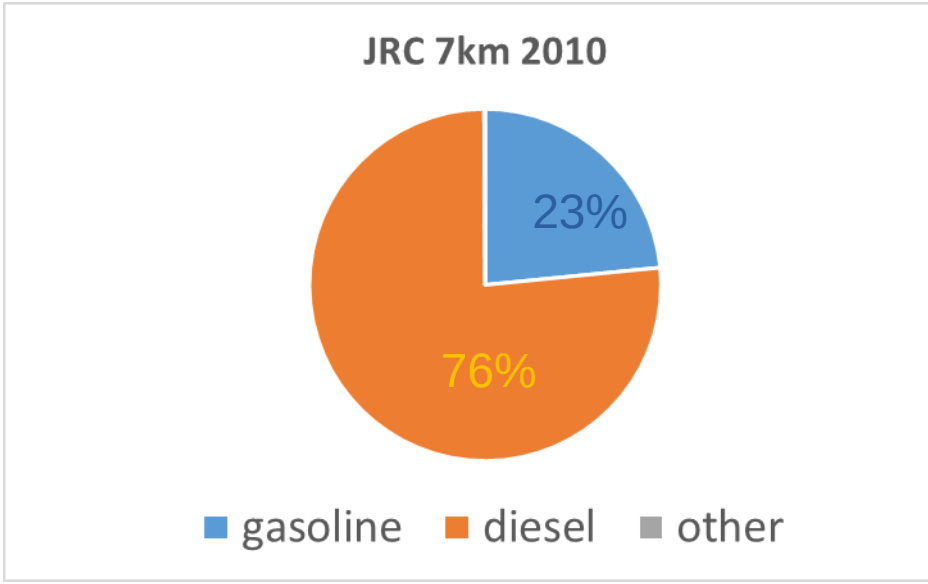
Geographical distributions BUP vs TOD

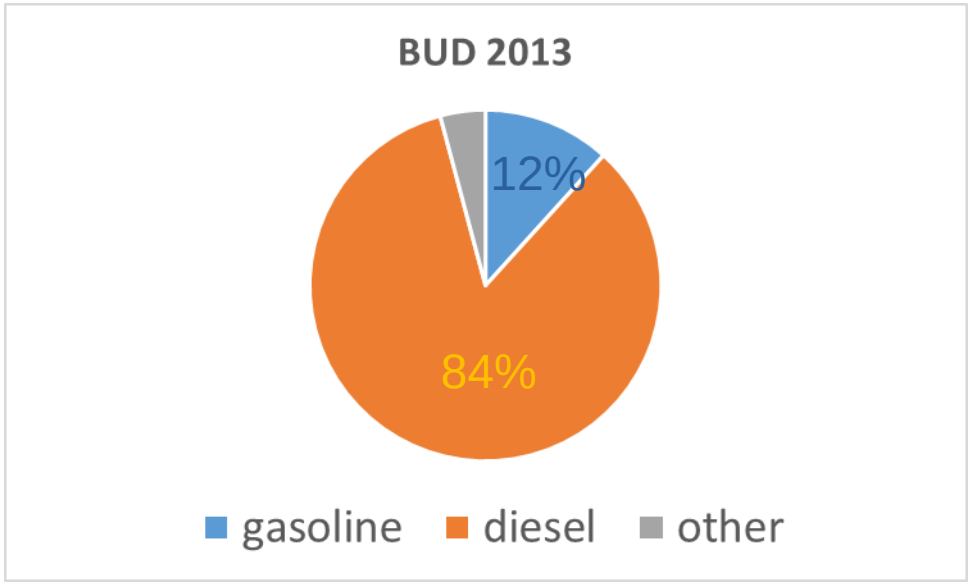


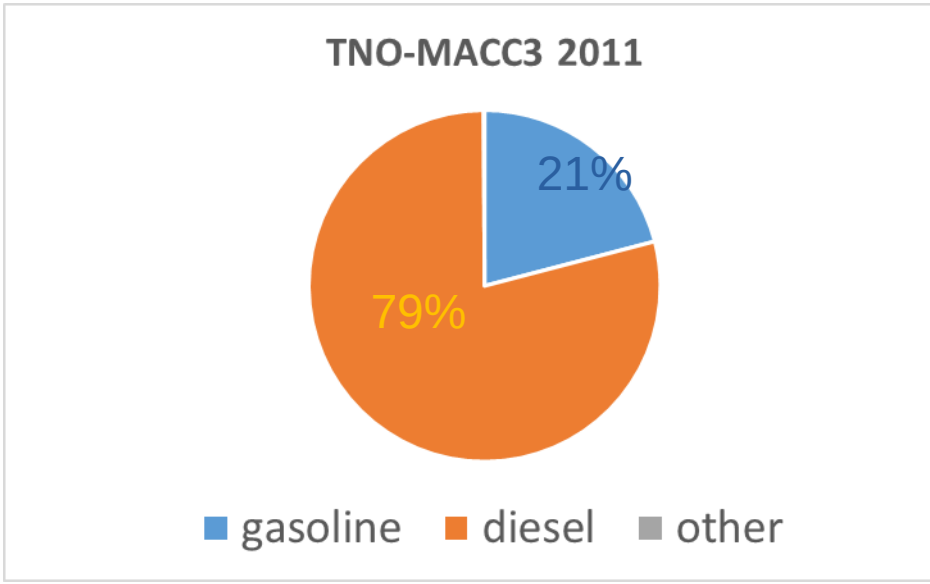


NO_x emissions from diesel and gasoline

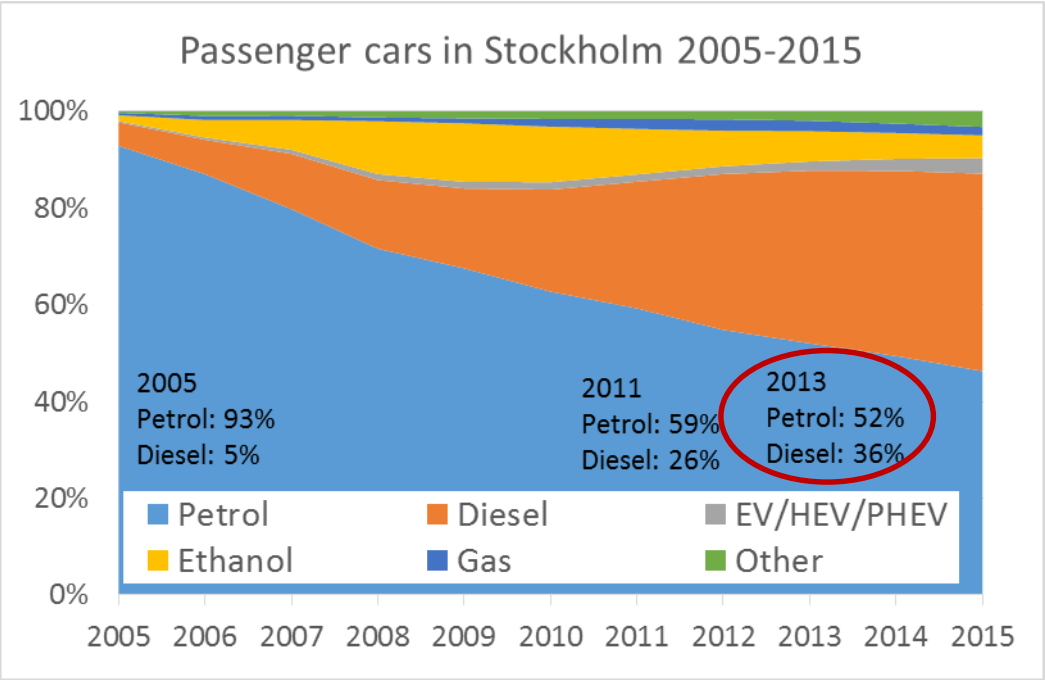


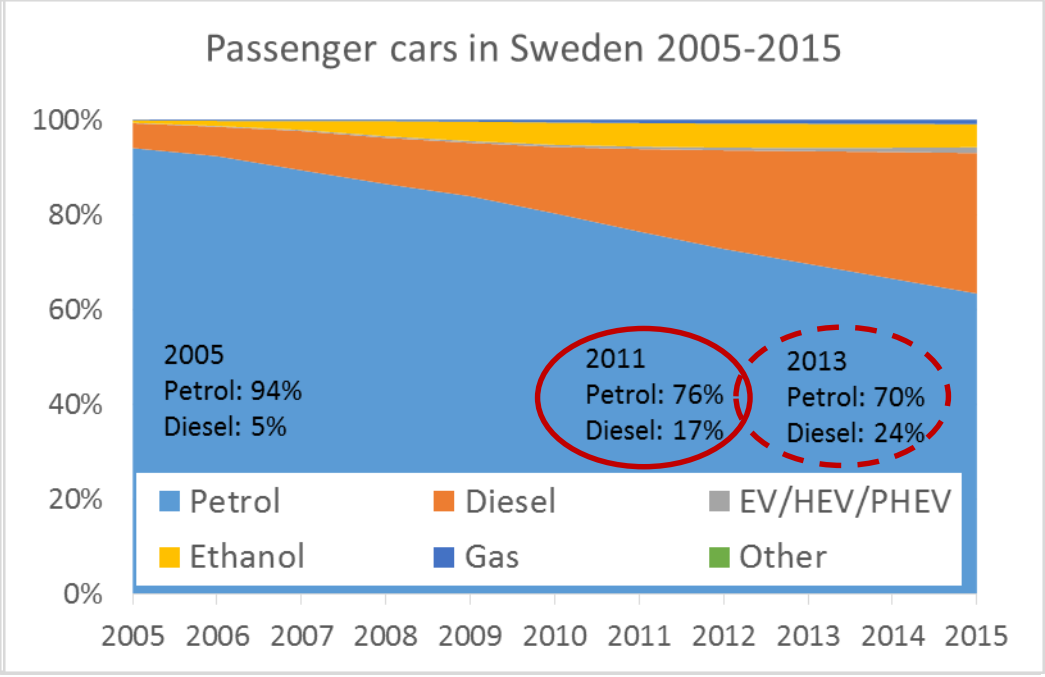






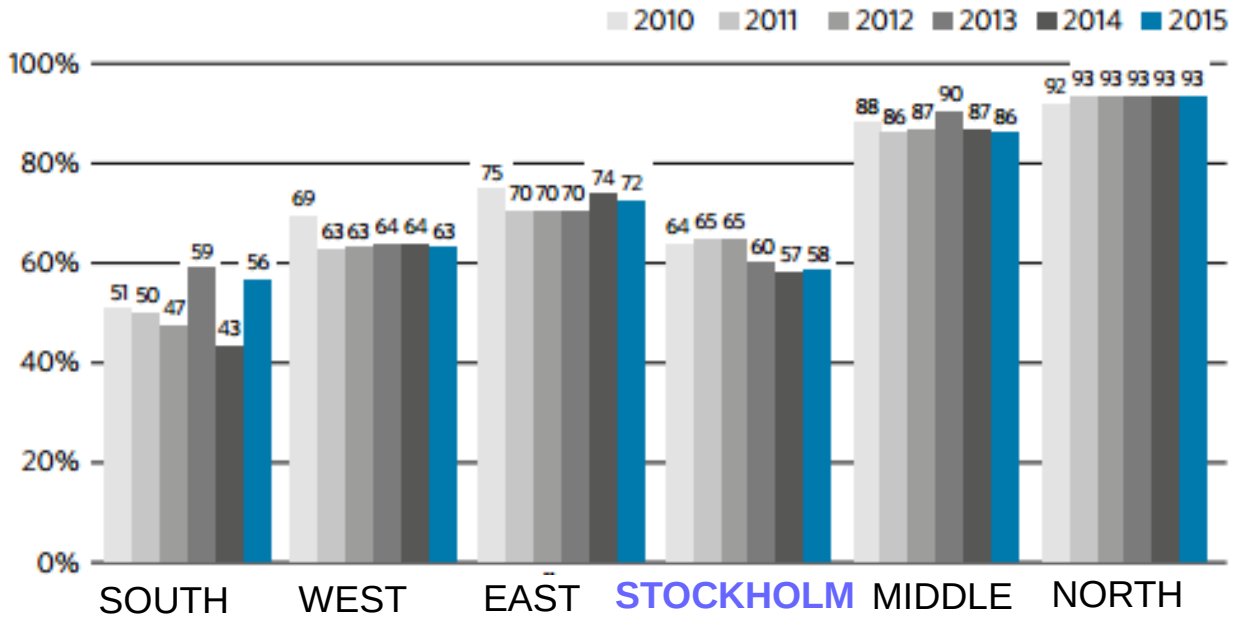
ol passenger cars

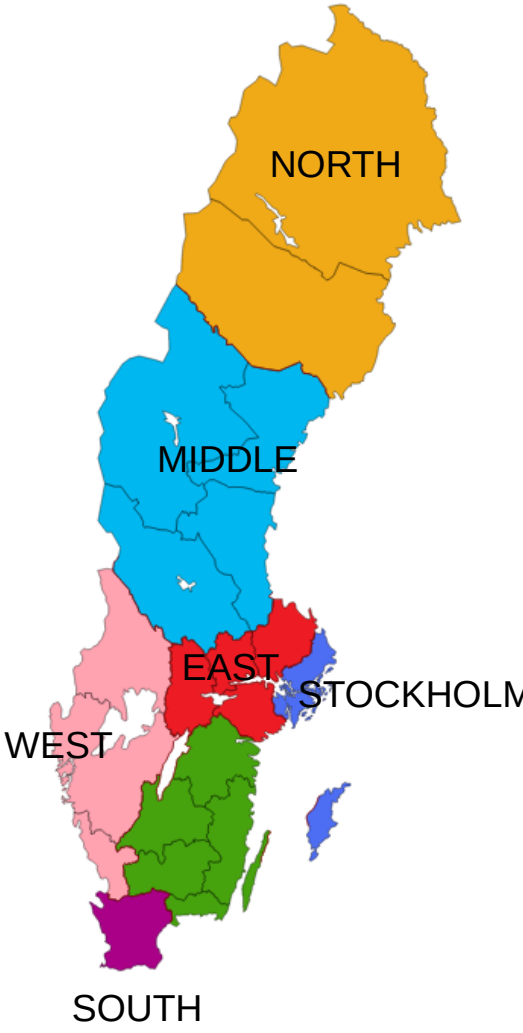




The share of passenger cars with studded tyres in Sweden during winter

- Lowest share of studded tyres in South and Stockholm region
- Decreasing trend





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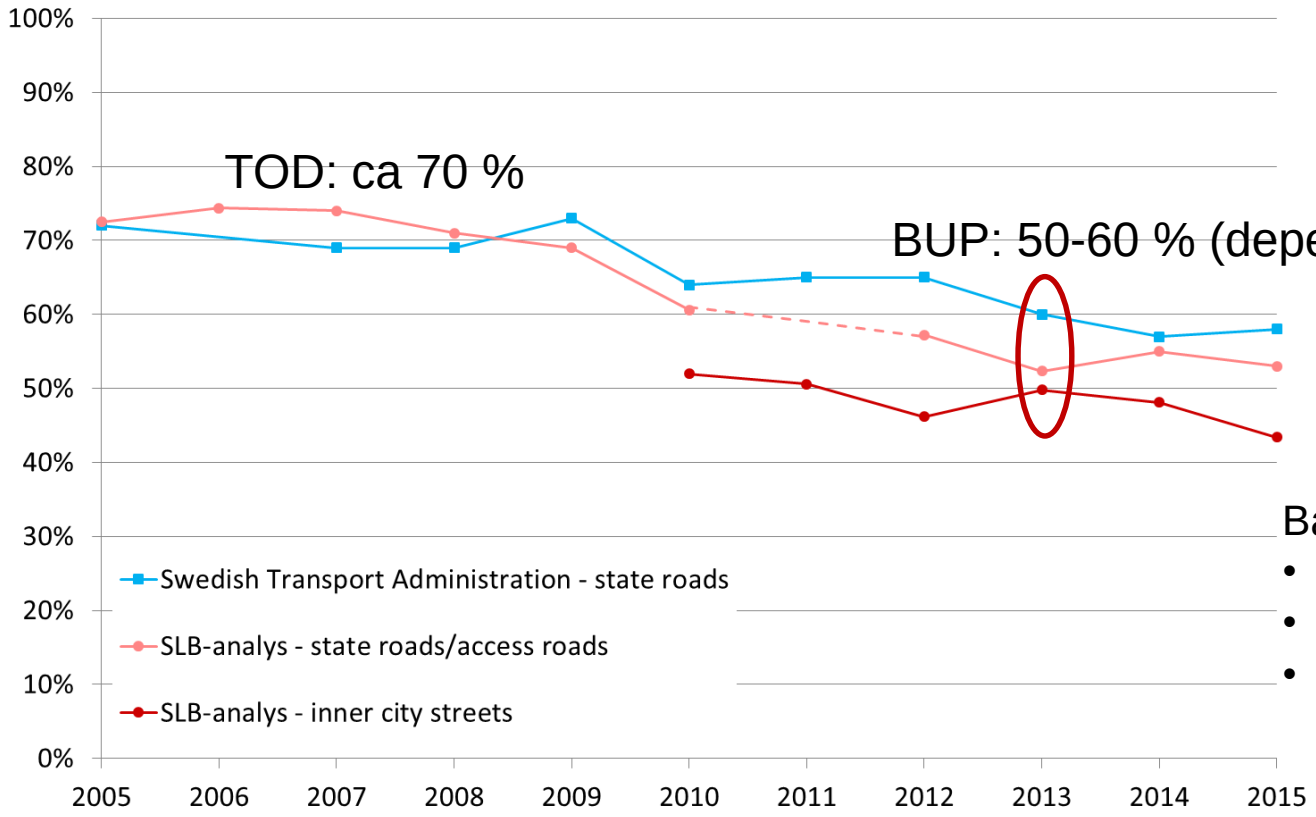


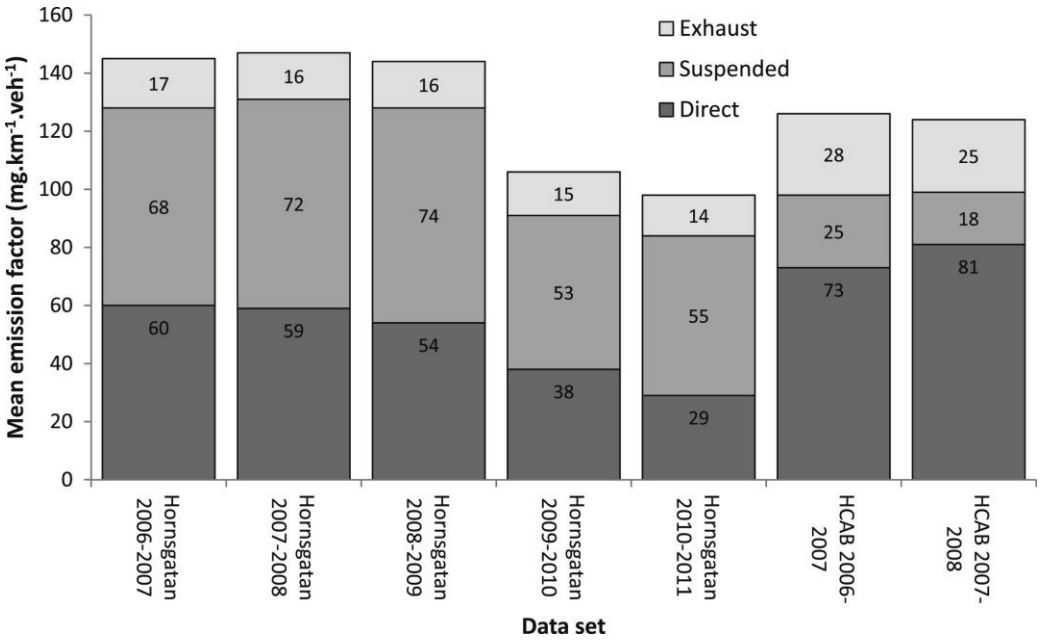
Ban against studded tyres

- Hornsgatan 1 Jan 2010
- Flemminggatan 1 Jan 2016
- Kungsgatan 1 Jan 2016

- Swedish Transport Administration's yearly survey (parked vehicles)
- SLB-anays measurements on passenger cars in traffic

Emission factors for road wear

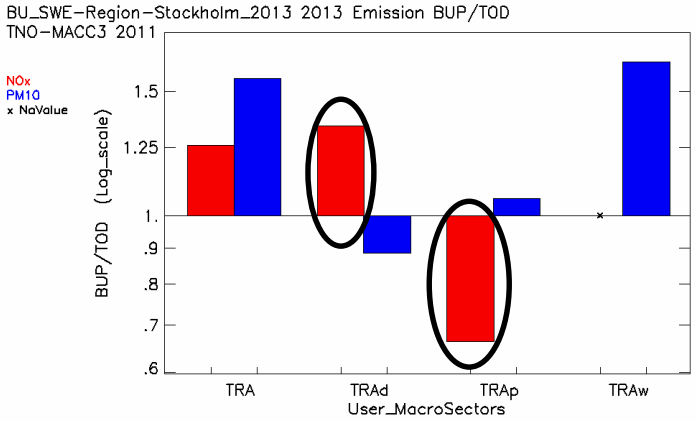
- SLB-analys emission data base (BUP)
  - EF based on non-exhaust emission model NORTRIP



Denby et al 2013. A coupled road dust and surface moisture model to predict non-exhaust road traffic induced particle emissions (NORTRIP). Part 1: Road dust loading and suspension modelling.

- Swedish air emission inventory for submission (TOD)
  - default EF from the EMEP/EEA (only direct emissions, not resuspension)
  - future: SIMAIR model with NORTRIP EF implemented

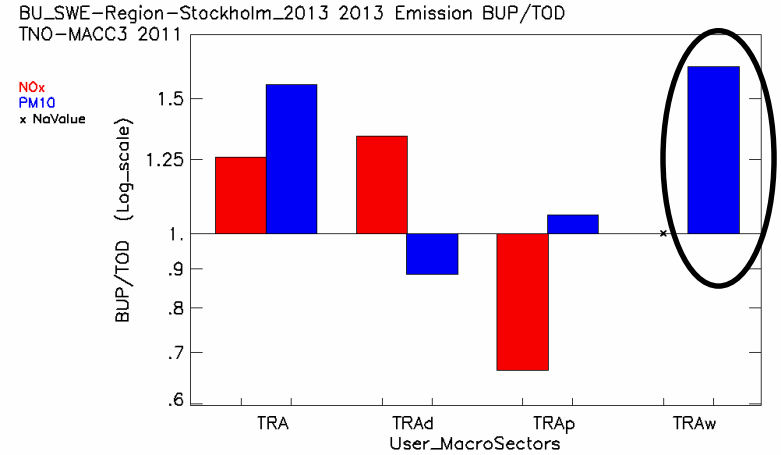
Summary NO_x



Emissions of NO_x from diesel vechicles			
Time trend	Increase in share of diesel passenger cars	2011<2013	TOD<BUP
Geographical variation	The share of diesel passenger cars is higher in Stockholm compared to Sweden	Sweden<Stockholm	TOD<BUP
Methodology/EF	TOD and BUP both based on Hbefa EF		
Sum of effects	Both time-trends and spatial variation of emissions contribute to TOD is lower than BUP		**TOD<BUP**

Emissions of NO_x from petrol vechicles			
Time trend	Decrease in share of petrol passenger cars	2011>2013	TOD>BUP
Geographical variation	The share of petrol passenger cars is lower in Stockholm compared to Sweden	Sweden>Stockholm	TOD>BUP
Methodology/EF	TOD and BUP both based on Hbefa EF		
Sum of effects	Both time-trends and spatial variation of emissions contribute to TOD is higher than BUP		**TOD>BUP**

Summary PM10

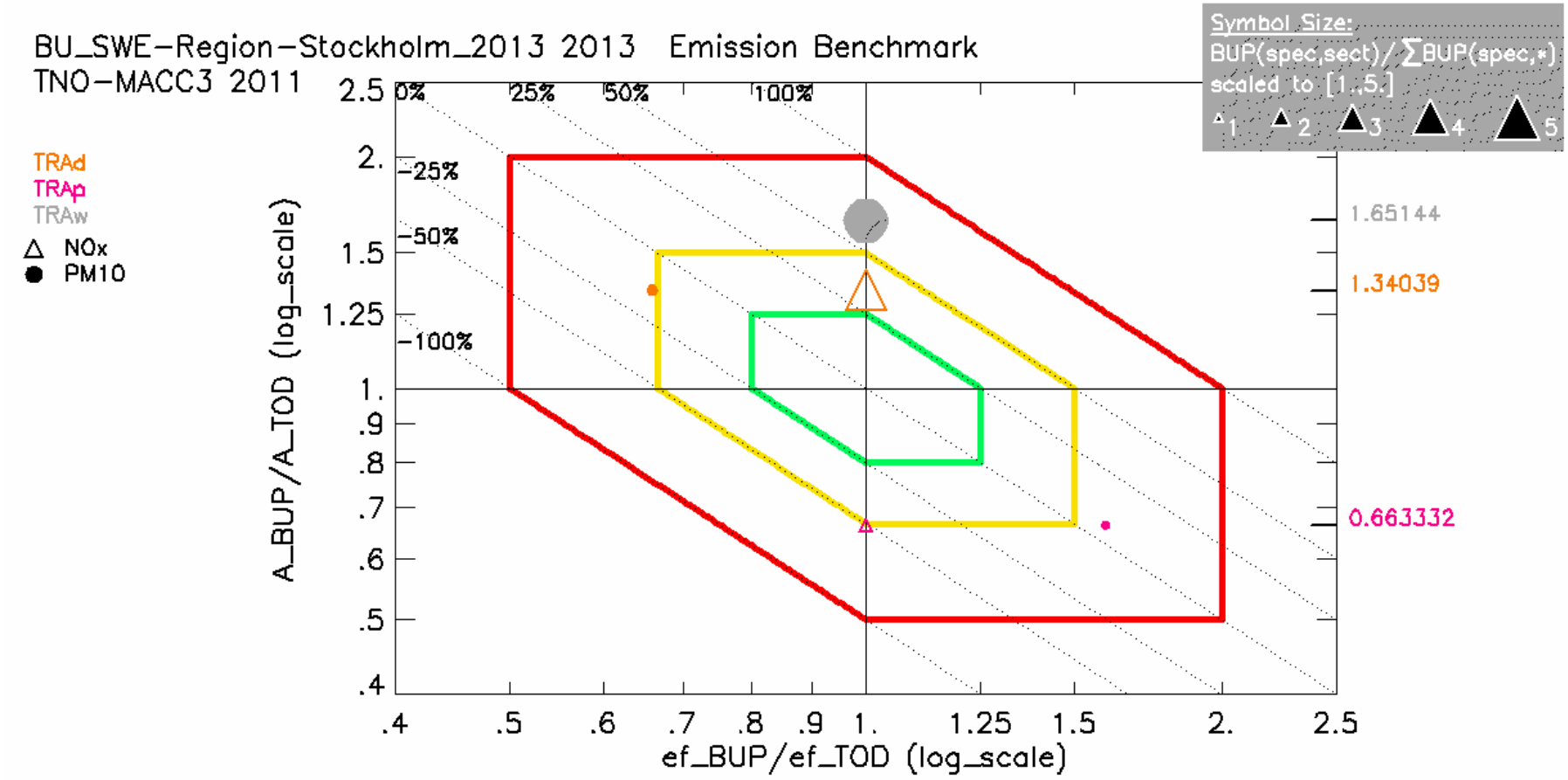


Emissions of road wear (PM10)			
Time trend	Decrease in share cars with studded tyres	2011>2013	TOD>BUP
Geographical variation	The studded tyre share is lower in Stockholm compared to Sweden	Sweden>Stockholm	TOD>BUP
Methodology/EF	TOD: EMEP/EEA, direct emissions BUP: NORTRIP, direct emissions and resuspension	Sweden<Stockholm	TOD<BUP
Sum of effects	Both time-trends and spatial variation of emissions contribute to higher emissions in TOD compared to BUP, while the difference in EF used between the two databases contribute to higher emissions in BUP compared to TOD. The different EF gives rise to much greater differences in emissions compared to the differences in the proportion of studded tires -> TOD<BUP		**TOD<BUP**

Concluding remarks

- To understand and analyze the differences between emissions of TOD and BUP it is important to consider:
  - time trends and geografical variations of the input parameters for the calculations of TOD and BUP emissions
  - calculation methodology and underlying emission factors for the calculations of TOD and BUP emissions
- Only after this is it valuable to study and analyze the more advanced diagrams provided in the Fairmode emission tool

Diamondplot



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Thank you!

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