Inverse Modelling of Ultrafine Particles Emissions in Copenhagen – A Case Study

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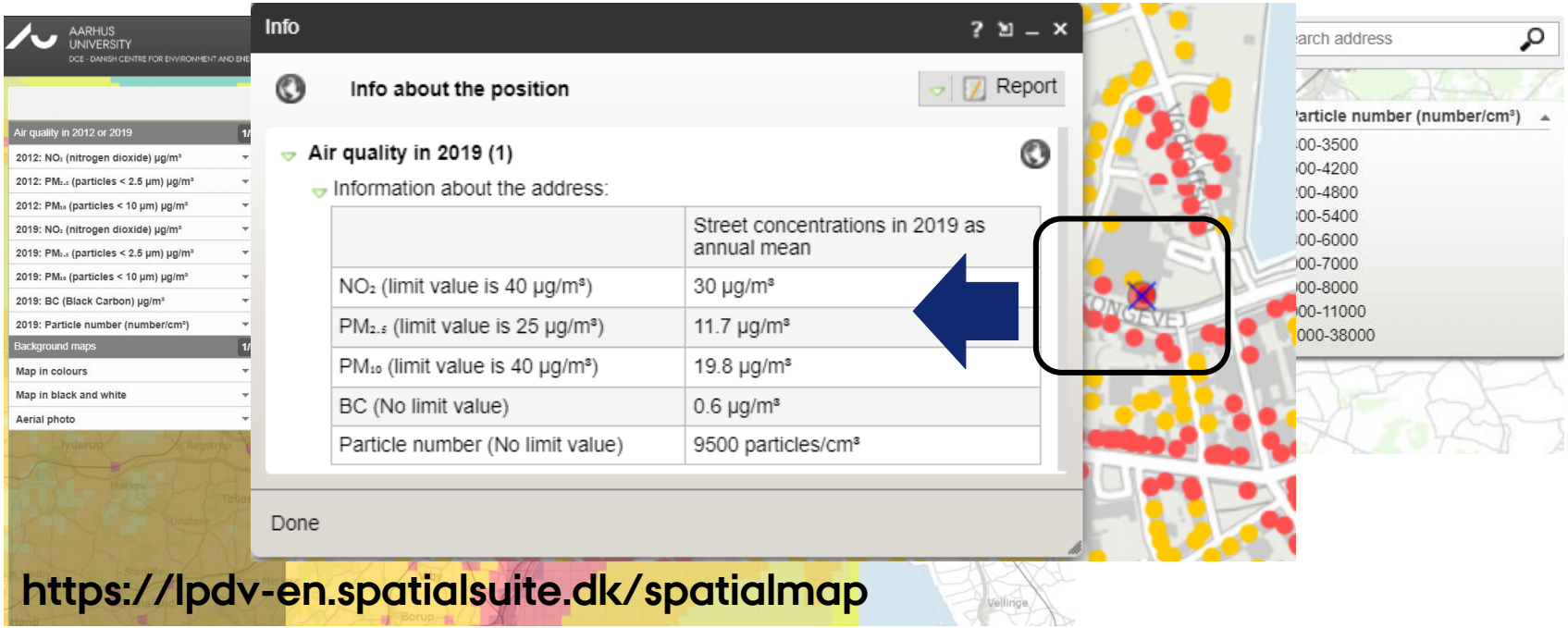
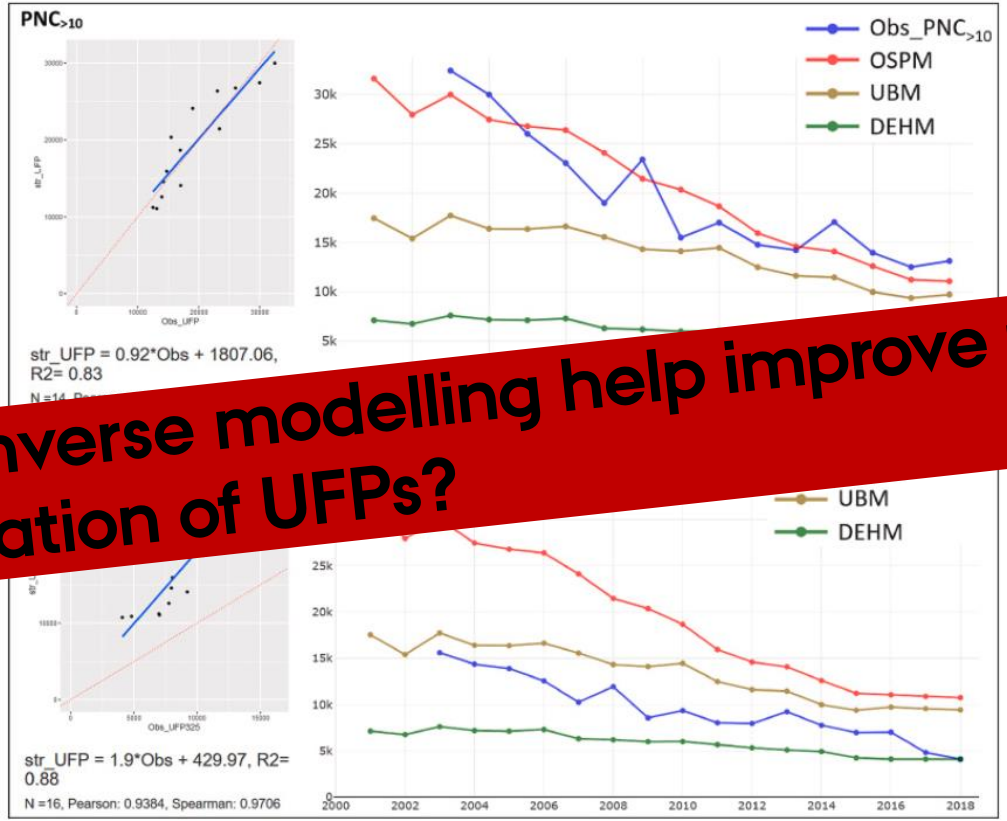
Background and Motivation

High-resolution air pollution modelling in Denmark



Background and Motivation



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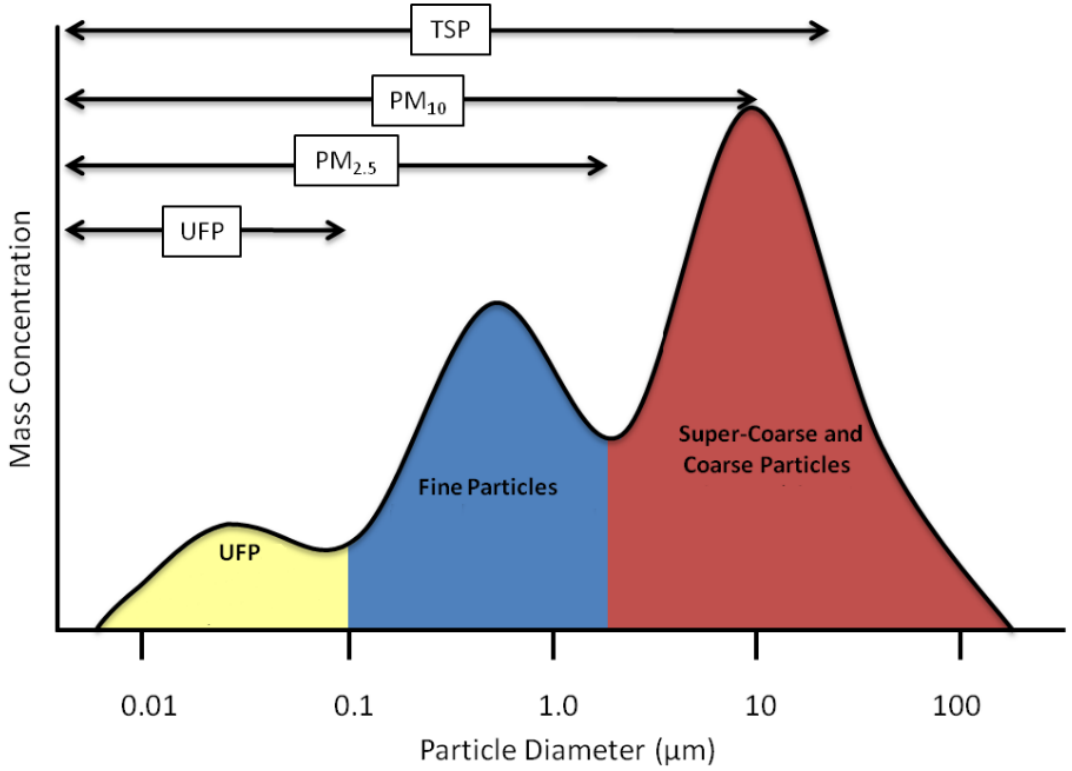
Can inverse modelling help improve the estimation of UFPs?

Background and Motivation

What are UFPs?



Background and Motivation

Health effects of UFPs

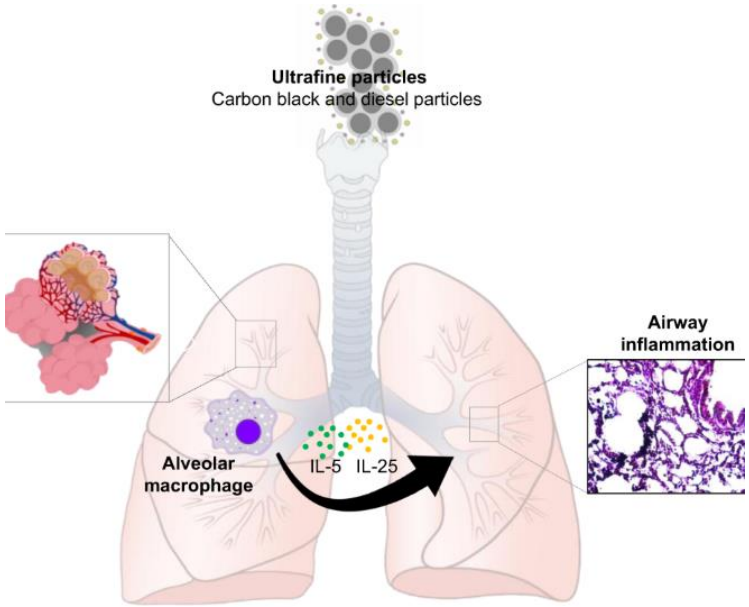
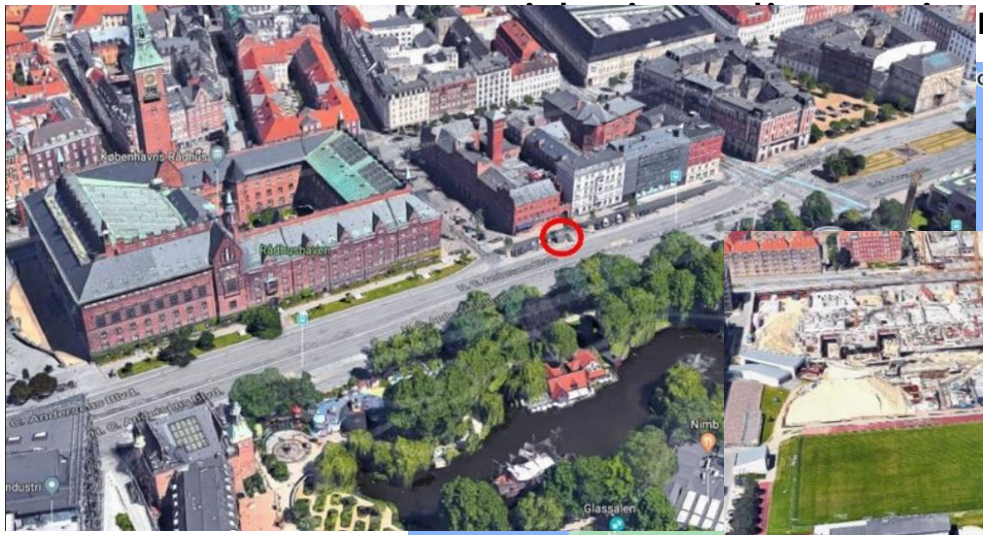
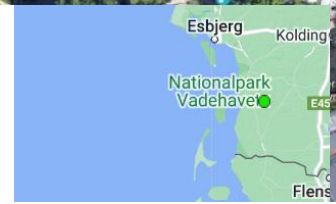


Image source: Leikauf et al. (2020)
https://www.nature.com/articles/s12276-020-0394-0

PNC / UFP Measurements (Copenhagen)



Street station



City background

PNC / UFP Measurements

Hourly quality controlled measured data for 2021 and 2022

The same data from the background monitoring station

Meteorological and traffic data was also obtained

Mean diurnal patterns of PNC for weekdays were explored

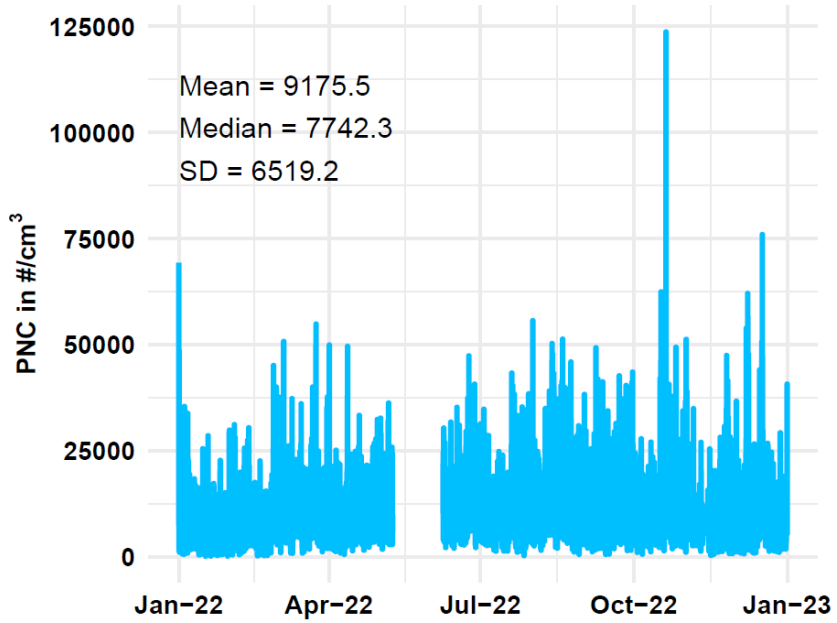
TSI's Scanning Mobile Particle Sizer (SMPS)

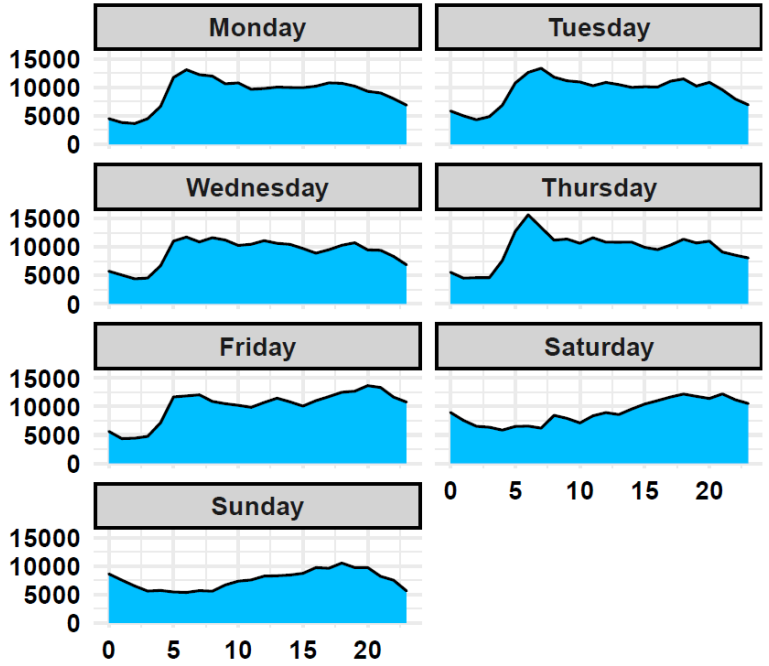
Inverse Modelling

$$Q_h = \frac{C_h - C_b}{F_h(met)\ X\ N}$$

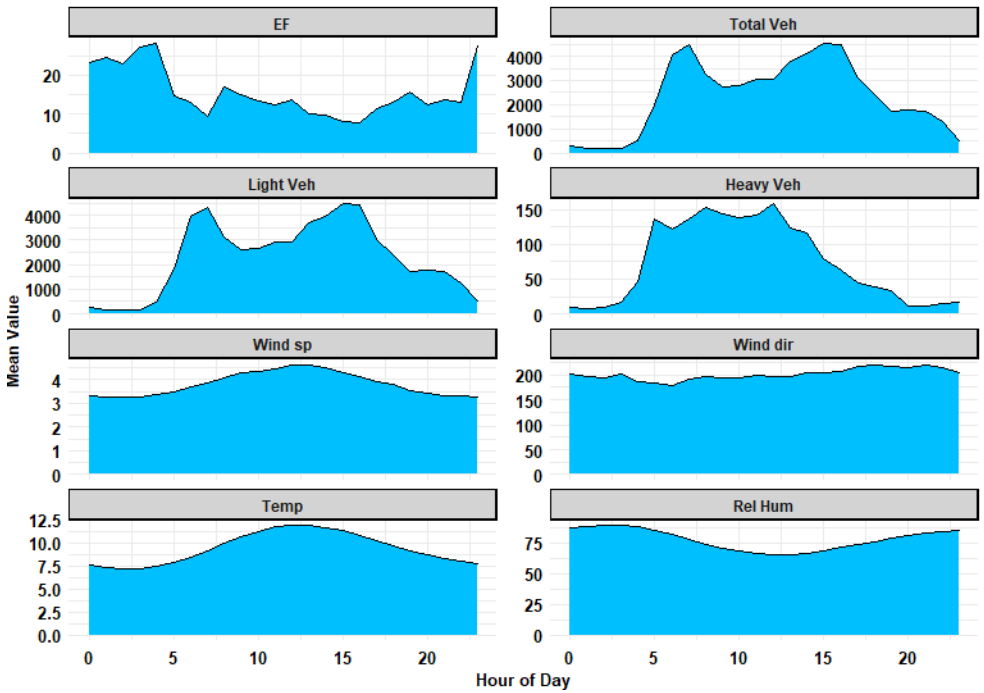
- Original method by Palmgren et al. (1999)
- Tested and implemented by, for example, Zhai et al. (2015) + more
- C_h is the hourly measured street concentrations
- C_b is the hourly measured background
- F_h (met) is the hourly meteorological factor. N is the total traffic volume

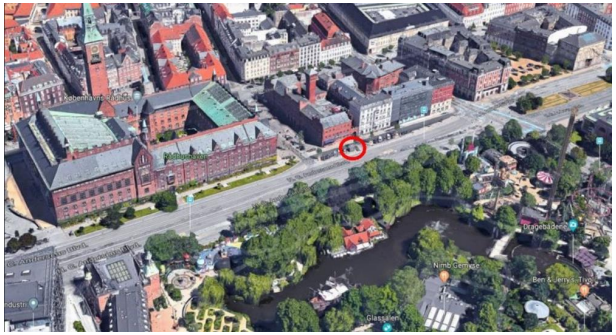
Measurements Results (2022)





EF, Met and Traffic (Monday)





Measurement station (Copenhagen)

Takeaways

Modelling PNC / UFP is challenging!

Inverse modelling (Classic, Bayesian and ML approaches) may potentially help improve the knowledge of emission factors

Good quality measurements are crucial but how to upscale (a challenge!) → Cost-effective → Partector 2


Aarhus University's Department of Environmental Science
Campus in Roskilde, Denmark
Thanks for listening!

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