



# Air quality assessment at the street level: sensitivity analysis of a road traffic-emissions-CTM model chain for the Paris region

Marjolaine Lannes, Yelva Roustan, Nicolas Coulombel

## ► To cite this version:

Marjolaine Lannes, Yelva Roustan, Nicolas Coulombel. Air quality assessment at the street level: sensitivity analysis of a road traffic-emissions-CTM model chain for the Paris region. 25th Transport and Air Pollution conference, Sep 2023, Göteborg (Sweden), France. hal-04461641

**HAL Id: hal-04461641**

**<https://hal.science/hal-04461641>**

Submitted on 19 Feb 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



# Air quality assessment at the street level: sensitivity analysis of a road traffic-emissions-CTM model chain for the Paris region

Marjolaine Lannes<sup>1,2</sup>, Yelva Roustan<sup>1</sup> and Nicolas Coulombel<sup>2</sup>

(1) CERE, École des Ponts ParisTech, EDF R&D, Marne-la-Vallée, France, (2) LVMT, École des Ponts ParisTech, Université Gustave Eiffel, Marne-la-Vallée, France

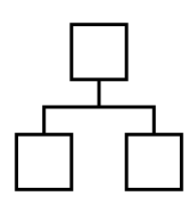
## INTRODUCTION



Public policies aiming to **improve air quality** focus mainly on vehicle fleet regulation & low emission zones



Need to assess the **effect of public transport policies** on urban air quality and personal exposure



Development of **modeling chain** from road traffic to chemical transport models (CTM) in recent years [1] [2]

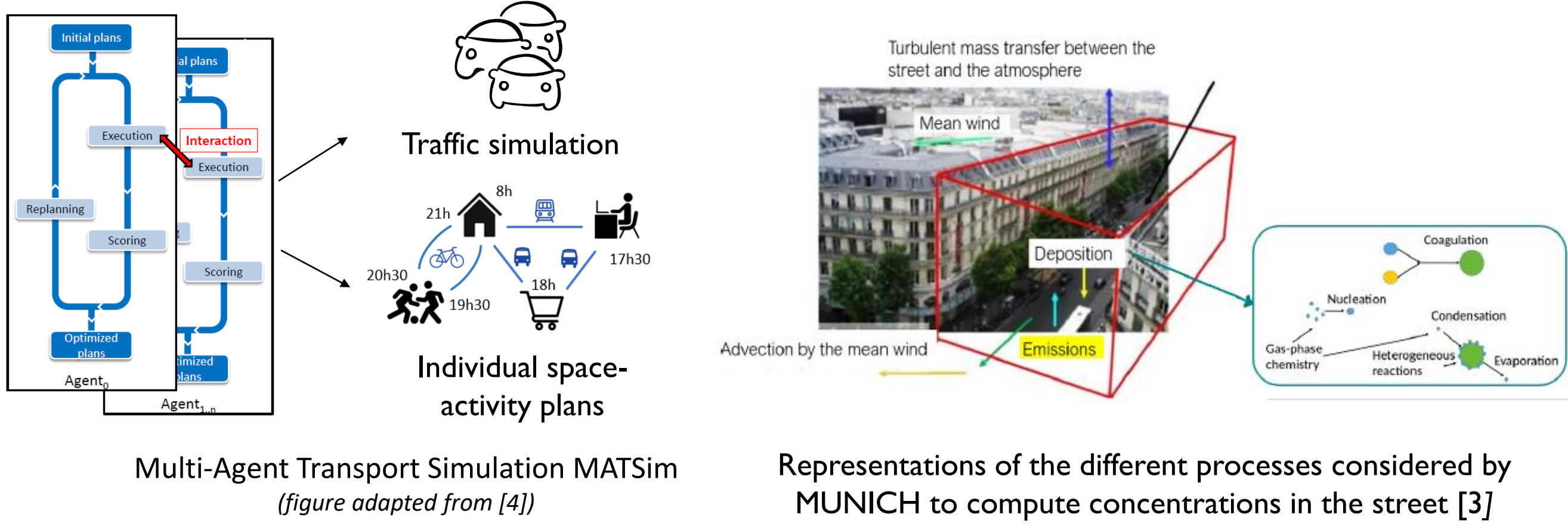


Uncertainties and model **sensitivity** to hypotheses remain little studied

## RESEARCH QUESTIONS

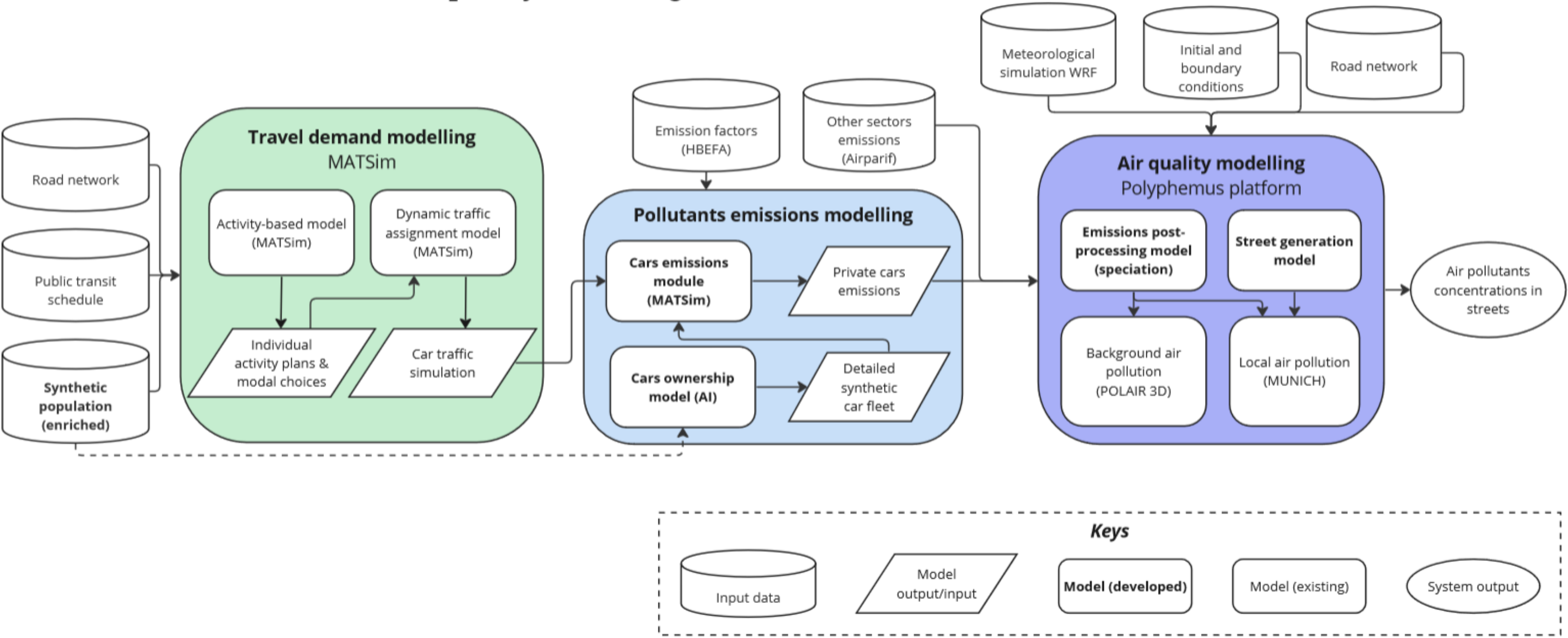
- 1) How to integrate high resolution traffic emissions into an air quality model based on street canyons?
- 2) How sensible to modeling hypotheses is the modeling chain?

## MODELS



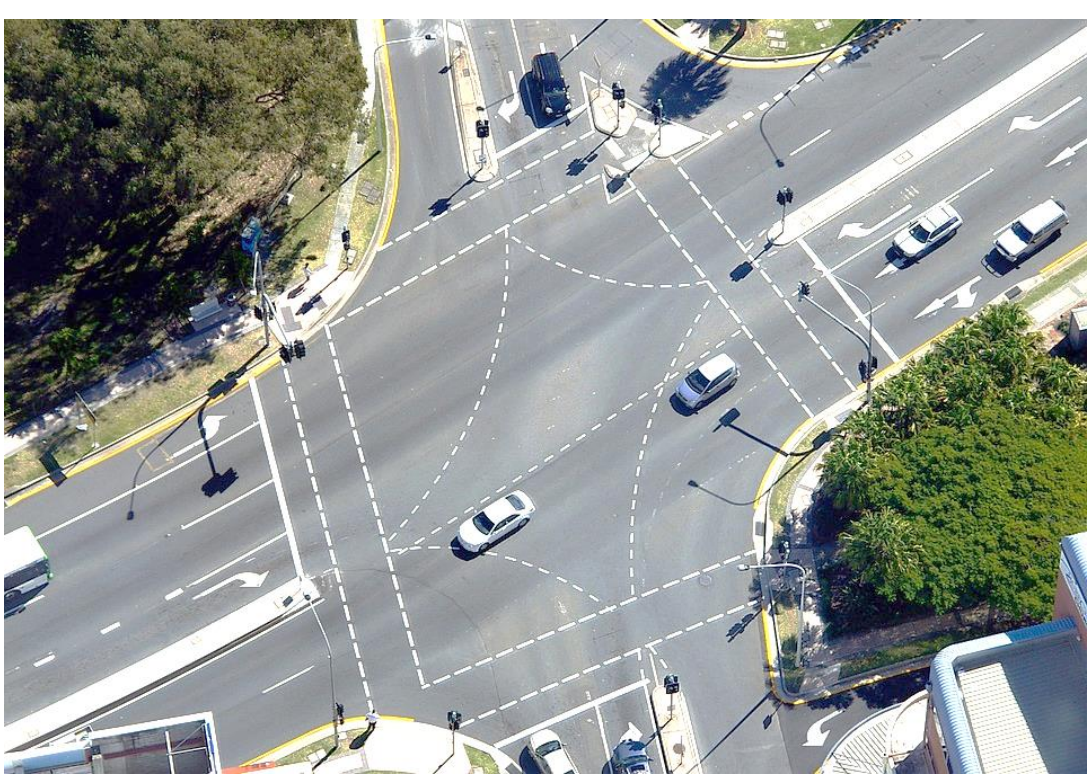
## METHODOLOGY

The integrated modelling framework for air quality assessment: travel demand - emissions - air quality modelling chain



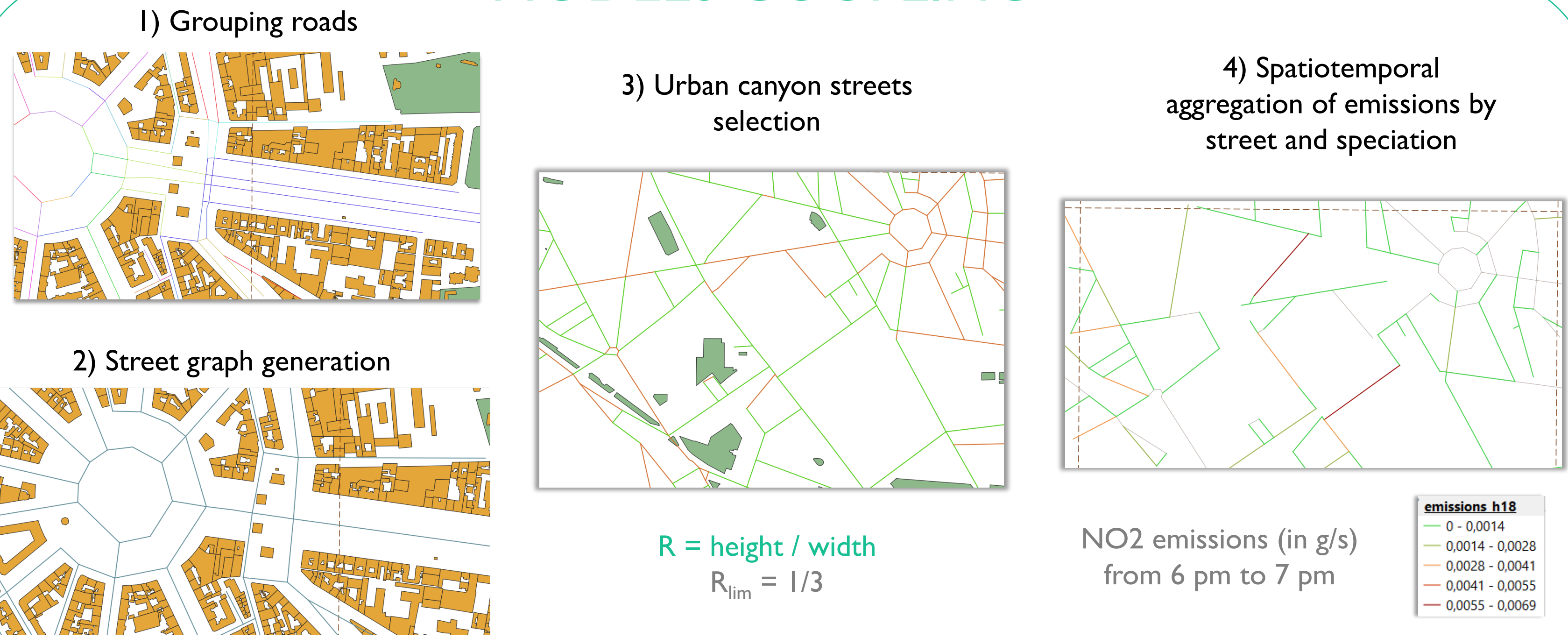
Modeling challenges

- 1 Urban modeling: based on roads vs. streets
- 2 Computational cost due to level of details required
- 3 Pollutants speciation (e.g. from PM emissions to emissions by size class and species)

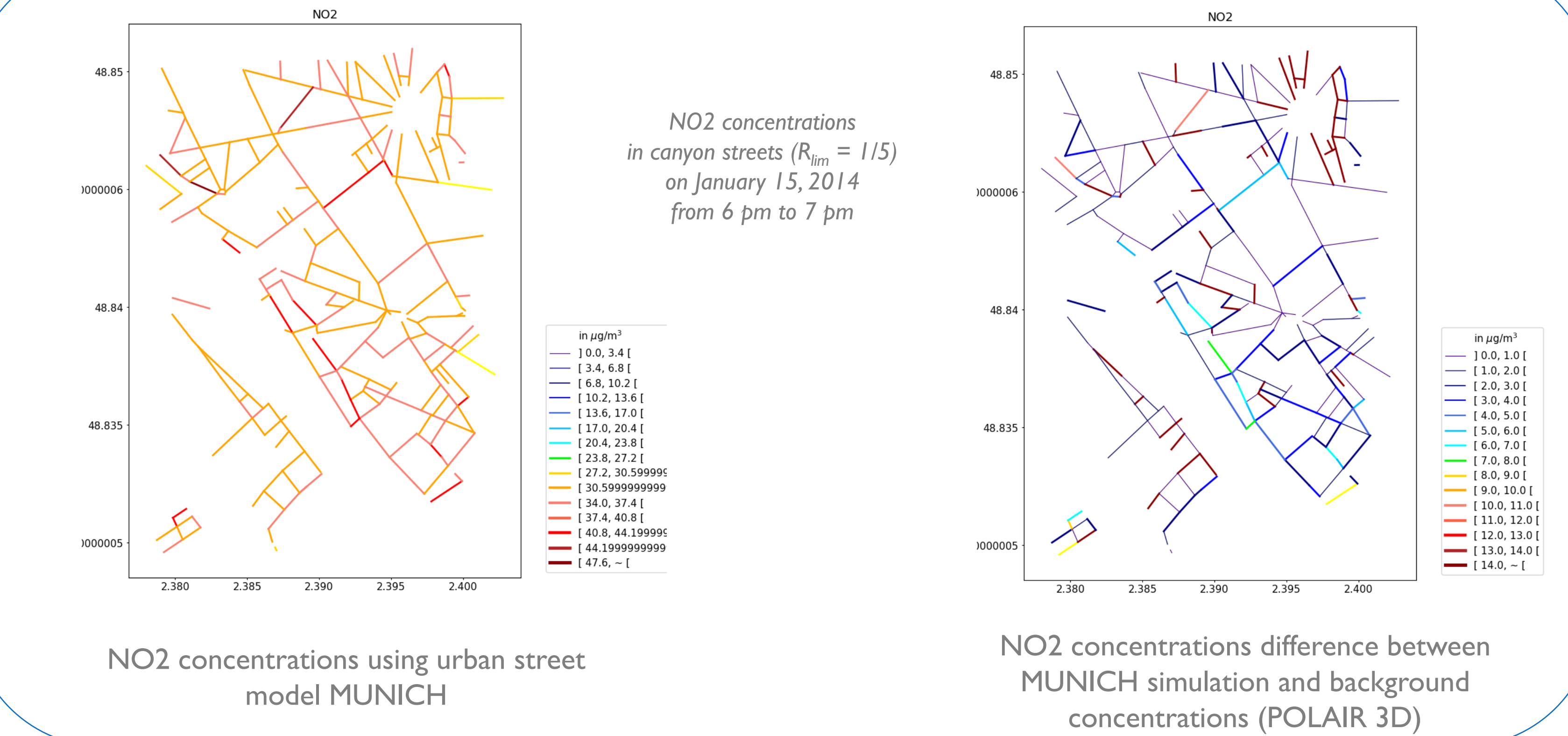


- In **transportation models**, **traffic lines and junctions** are used as a basis for urban modeling
- Chemical transport models** rely on a **built environment** model based on streets and intersections

## MODELS COUPLING



## SENSITIVITY ANALYSIS



## CONCLUSIONS

- Development of an **open-source** air quality modeling platform based on multi-agent transportation model MATSim, CTM and urban street-network model.
  - Calculation costs**: ~1 week simulation for the street network model
  - Sensitivity analysis** show the contribution of street-level resolution for both road traffic emissions and air quality modeling.
- Perspectives :
- Development of an **exposure model**
  - Complementary sensitivity tests including cars emissions, temporal resolution...

## BIBLIOGRAPHY

- [1] Gurram, Sashikanth, Amy Lynette Stuart, and Abdul Rawoof Pinjari. 2019. 'Agent-Based Modeling to Estimate Exposures to Urban Air Pollution from Transportation: Exposure Disparities and Impacts of High-Resolution Data'. *Computers, Environment and Urban Systems* 75: 22–34.
- [2] Vallamsundar, Suriya et al. 2016. 'A Comprehensive Modeling Framework for Transportation-Induced Population Exposure Assessment'. *Transportation Research Part D: Transport and Environment* 46: 94–113.
- [3] Lugon Lya, 2021. 'Modélisation de la qualité de l'air dans les rues de Paris'. <https://www.theses.fr/2021ENPC0011>
- [4] W Axhausen, K., Horni, A., & Nagel, K. 2016. 'The multi-agent transport simulation MATSim' (p. 618). Ubiquity Press.



marjolaine.lannes@enpc.fr  
<https://github.com/marjolainelannes>



Research funded by  
île de France

