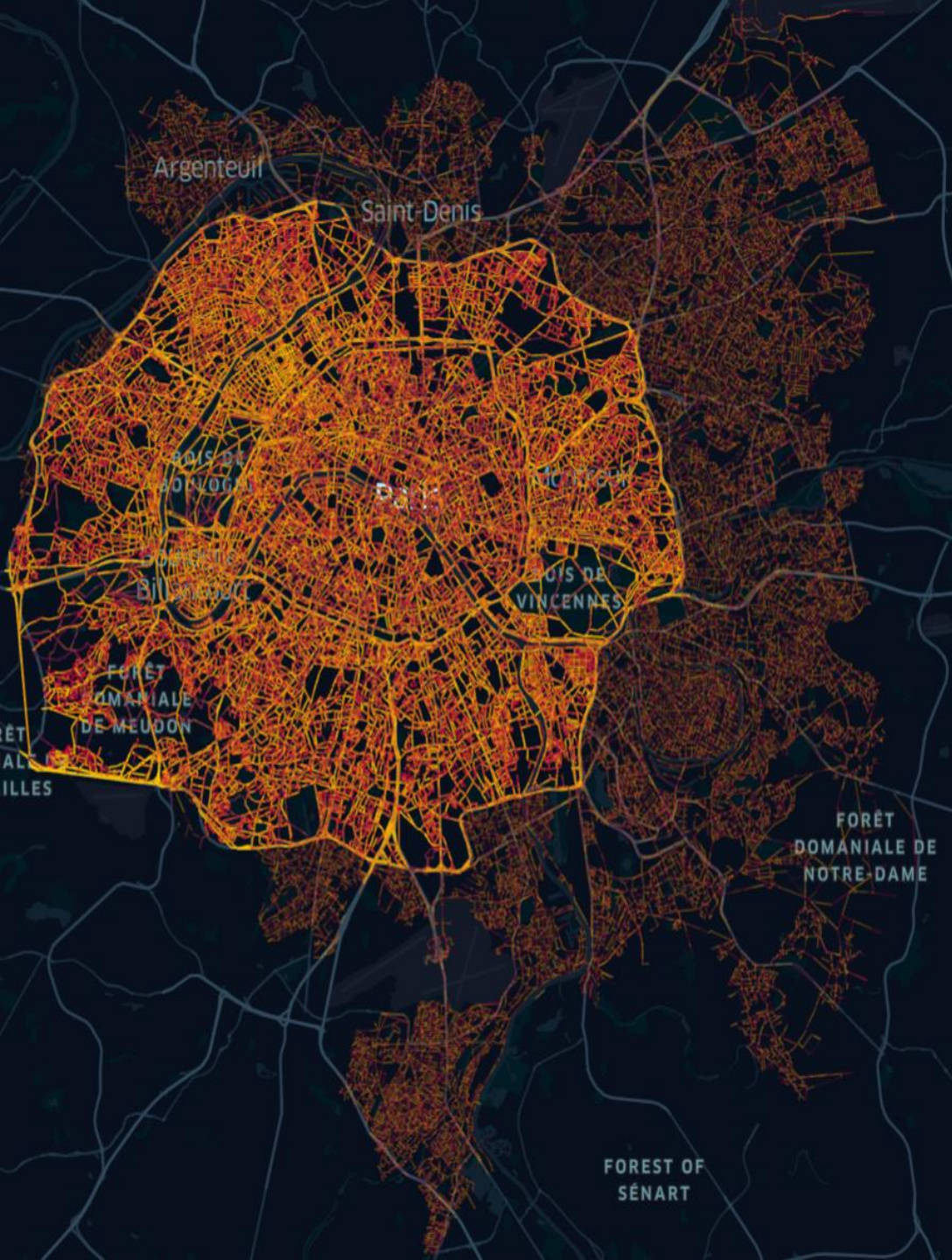MATSim user meeting 2023

EVALUATION OF THE LOW EMISSION ZONE ACCORDING TO THE EVOLUTION OF

CAR-OWNERSHIP: THE MÉTROPOLE DU GRAND PARIS CASE STUDY

Azise Oumar Diallo[a], Pierre Michel[a], **Guoxi Feng**[a], Alexandre Chasse[a]

[a]*IFP Energies Nouvelles France*

AGENDA

- Introduction
  - General context
  - Research question
- Existing works
- Methodology and assumptions
- Results
  - Study area description
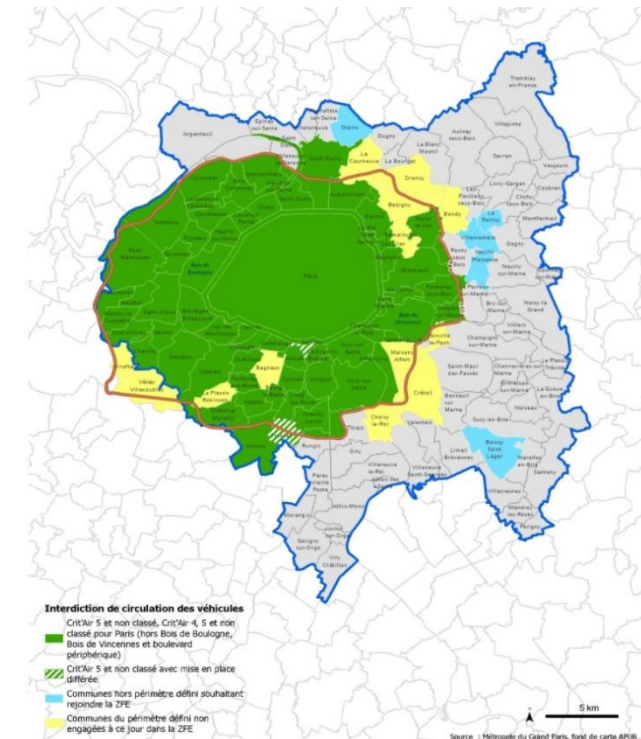 - Simulation Results
- Conclusion and perspectives

AGENDA

- **Introduction**
- Existing works
- Methodology and assumptions
- Results
- Conclusion and perspectives

GENERAL CONTEXT

- **Transport negatives externalities (in 2019, France)**
  - **31.1% greenhouse gas (GHG)** emissions with **52.79% of private cars[1]**.
  - **51.8% of NO_2 , 16% of PM2,5 , 11% of CO** , emissions[2].
  - **56,016 accidents** with **3,244 deaths[3]**
  - **10 million people** exposed to **noise levels** above **65 dBA[4]**.

- **Policy measures to reduce private car use[5]**
  - **Urban toll or congestion charging:** London (UK), Stockholm (Sweden)
  - **Low emission zones:** Stockholm (Sweden), **Paris (France)**
 - **Pollution Emergency:** Geneve (Switzerland)

1. *Source: Citepa, rapport Secten, juillet 2021*
2. *Source: Citepa, rapport Secten, mai 2020*
3. *Source: ONISR*
4. *Source: ADEME (AIR ET MOBILITÉS)*
5. **https://urbanaccessregulations.eu/**

https://urbanaccessregulations.eu/countries-mainmenu-147/france/paris

RESEARCH OBJECTIVE

- How to evaluate the impact of the low emission zone (ZFE) according to the evolution of the current fleet (2022) until 2030 according to the forecast schedule?
  - According to the change in mobility behavior of individuals
  - According to transport emissions
 - **Low emission zone** policy in 2019 to 2030 ➔ 77 municipalities around A86
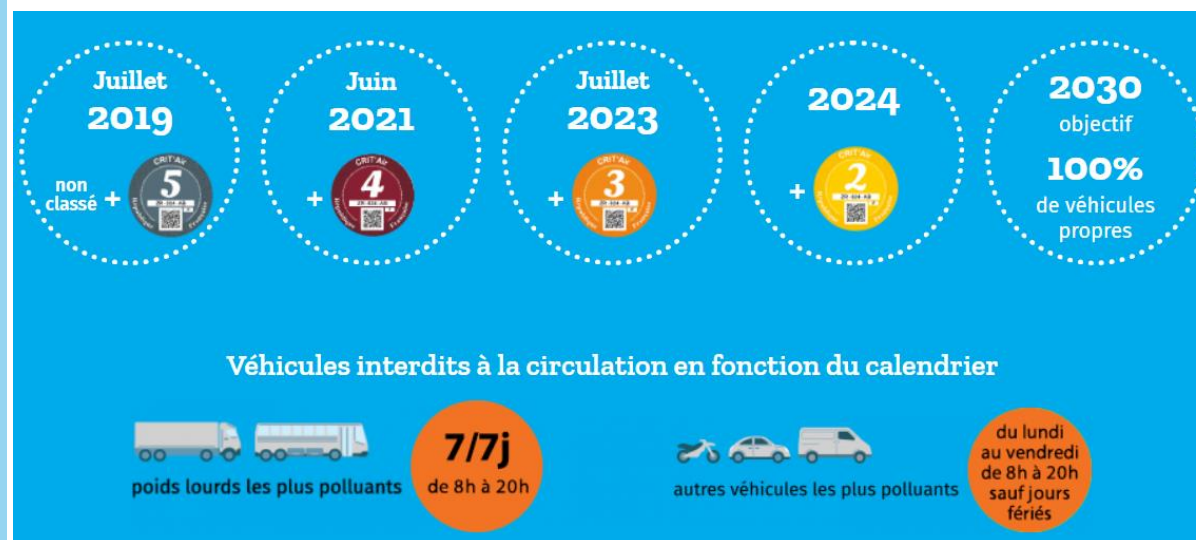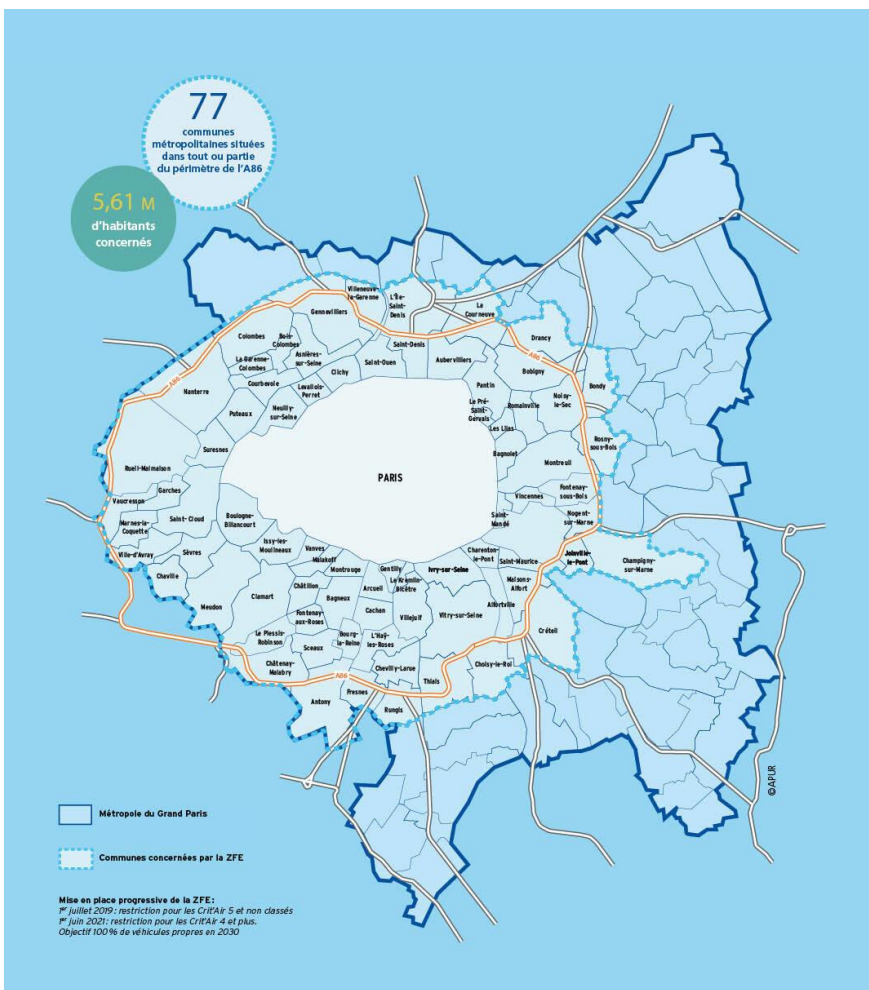
https://www.zonefaiblesemissionsmetropolitaine.fr/

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SIMULATION SETUP

- Eqasim
  - Synthetic population generation with survey data (Île-de-France)
  - Transport supply: OSM and GTFS
  - Discrete Mode Choice extension under MATSim framework
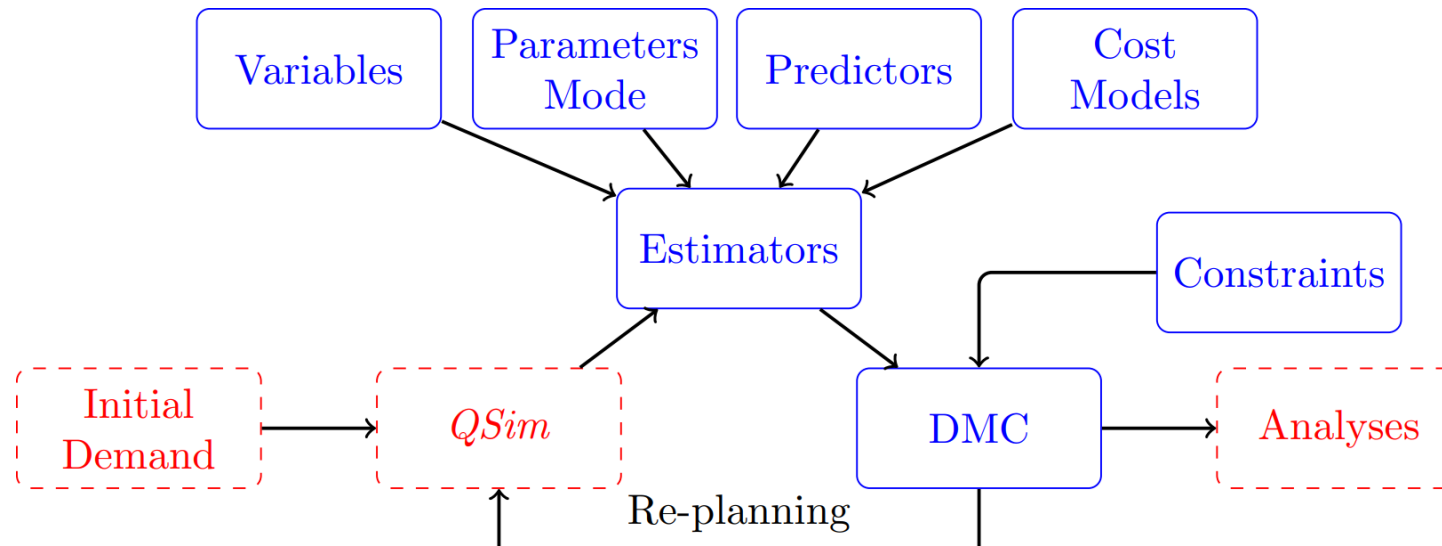
1. Horl, S., Balac, M., Axhausen, K.W.: Pairing discrete mode choice models and agent-based transport simulation with matsim. In: TRB Annual Meeting (2019). Transportation Research Board
2. https://github.com/eqasim-org/ile-de-france

PRIVATE CAR REDUCTION POLICY

- Evaluation of Low-Traffic Neighborhoods and Scale Effects: The Paris Case Study[1]
  - **Driving restriction zone (DRZ)** *vs* low emission zone (LEZ)
  - Two policy scenarios according to the size of the restriction zone:
    - Zone A → Municipality's plan
    - Zone B → Theorical plan
  - Based on IdF MATSim/Eqasim model
  - Two intermodal alternatives *Car+Walk* and *Car+PT*
  - Findings:
    - **Few modal shift** in the Zone A compared to the Zone B
    - **Reduction** of traffic emissions in the restriction zone (especially in the Zone B) *vs increase* in the outside of the city center (Zone A)
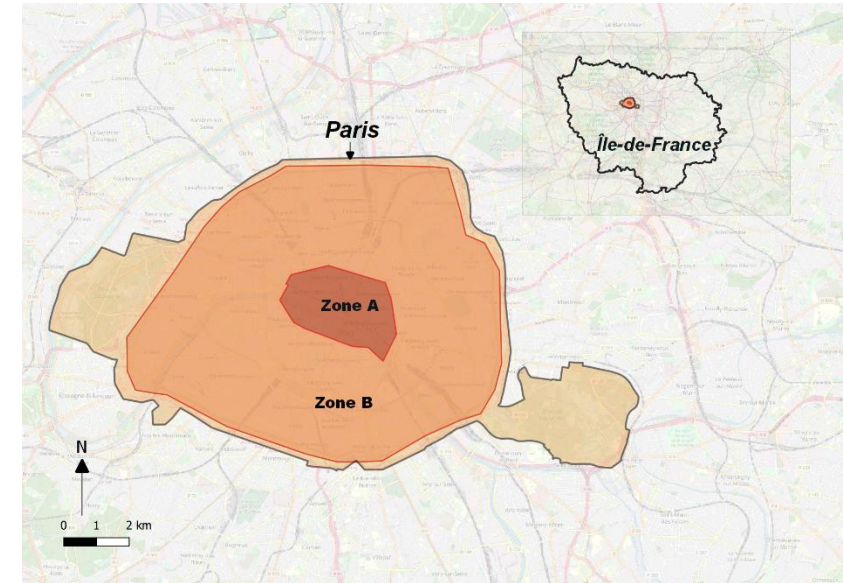

Source: From Biao Yin et al.[1]

1. Biao Yin, Azise Oumar Diallo, Tatiana Seregina, Nicolas Coulombel, Liu Liu. Evaluation of Low-Traffic Neighborhoods and Scale Effects: The Paris Case Study. Transportation Research Record, 2023

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GENERIC MODELING APPROACH

● Agent-based modeling
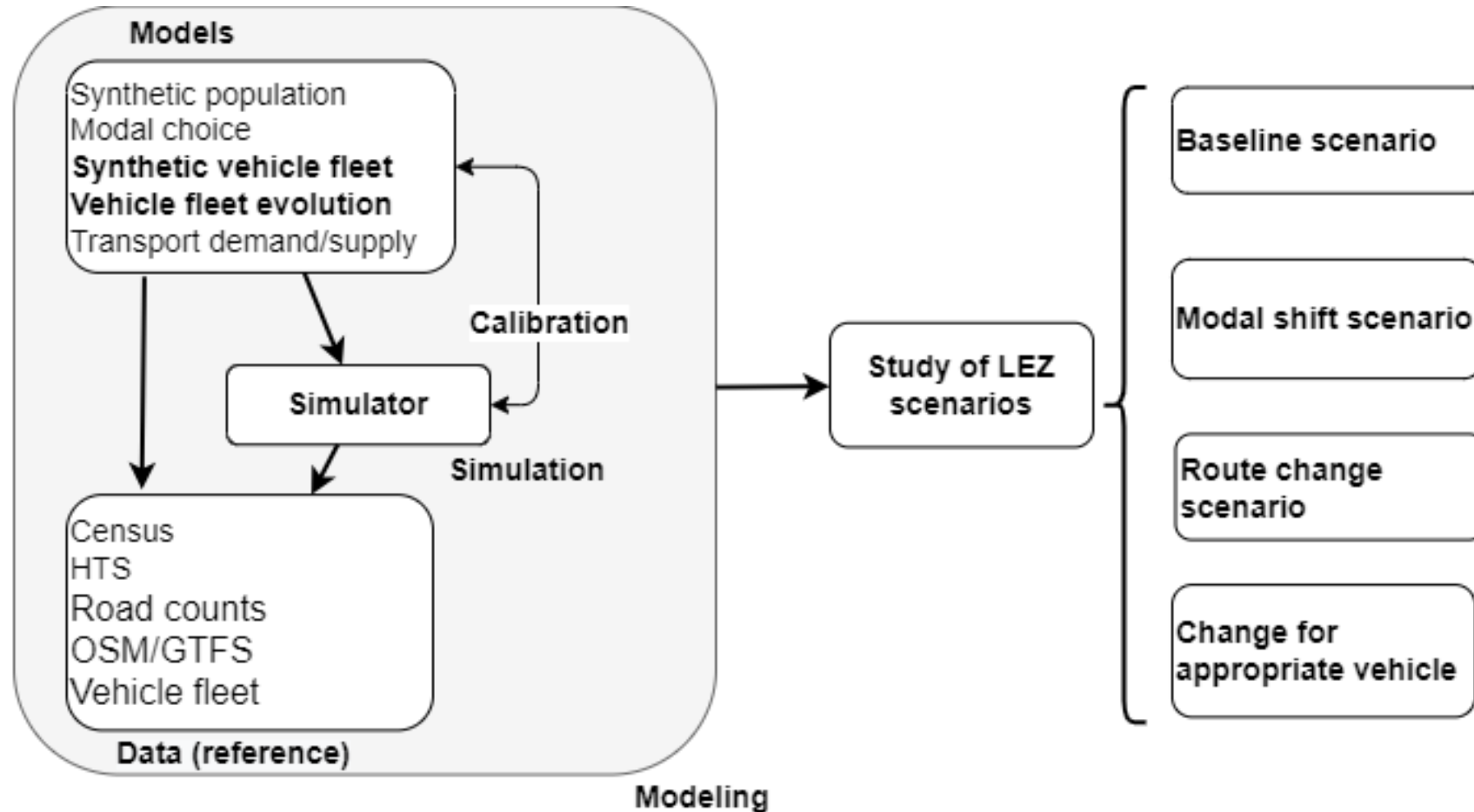
AGENT VEHICLE FLEET GENERATION

- Developed by Valentin LE BESCOND[1]

- Based on French car fleet data (SDES) (with motorization, age, Crit'Air sticker).

- Euro category determination based on the age and Crit'Air sticker

- Random allocation of vehicles to agents based on the fleet of vehicles per municipality.

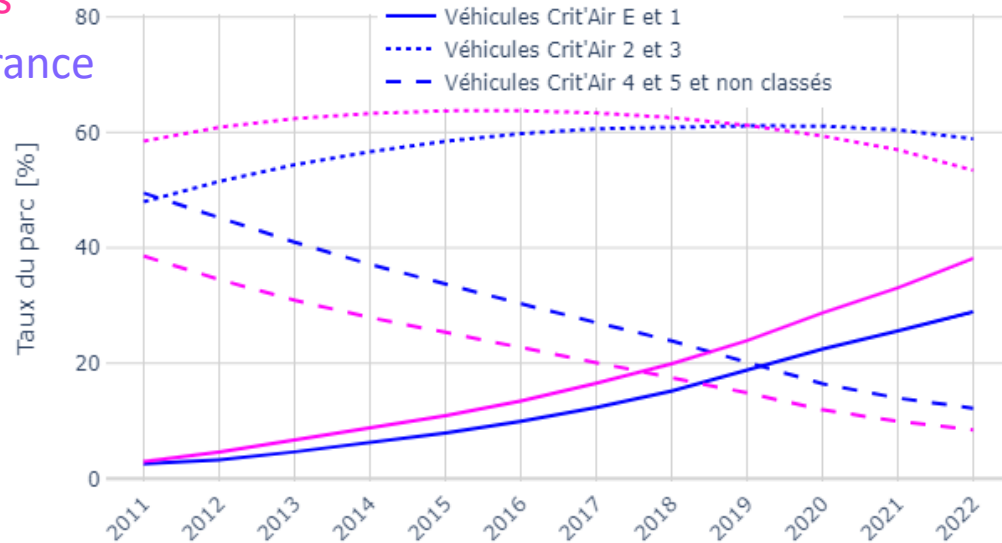- Allows the use of the MATSim **emissions contrib** with HBEFA 4.2.

1. https://github.com/eqasim-org/ile-de-france/pull/104
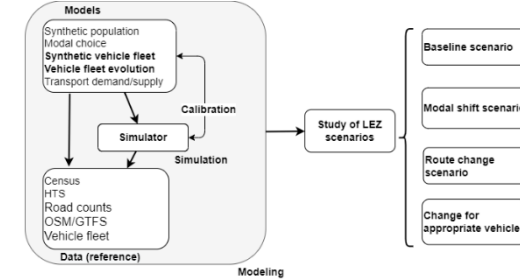
VEHICLE FLEET EVOLUTION MODELING

- Based on "**phenomenological**" modeling
- From previous observations 2011 to 2022
- Department scale imputation
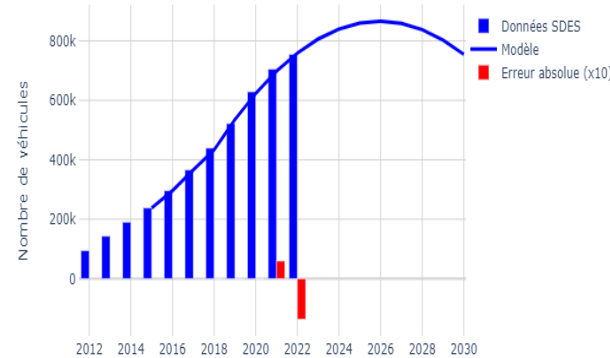- Project for 2024, 2027 and 2030
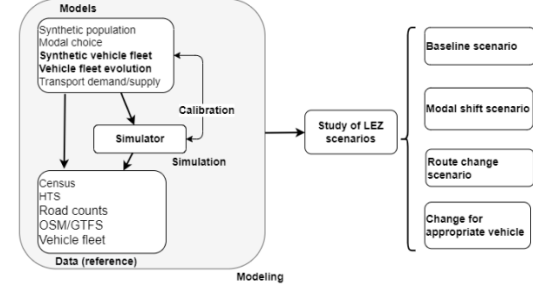
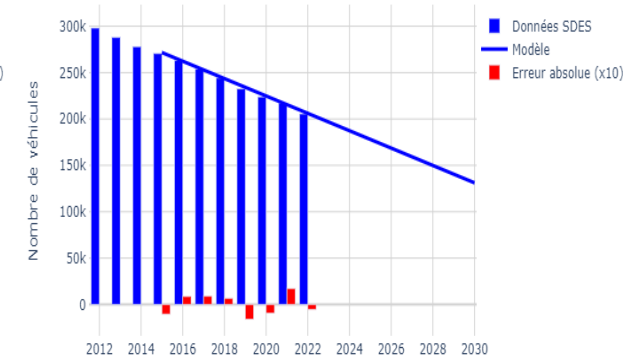Parc Véhicule Léger immatriculé au 1er janvier 2022
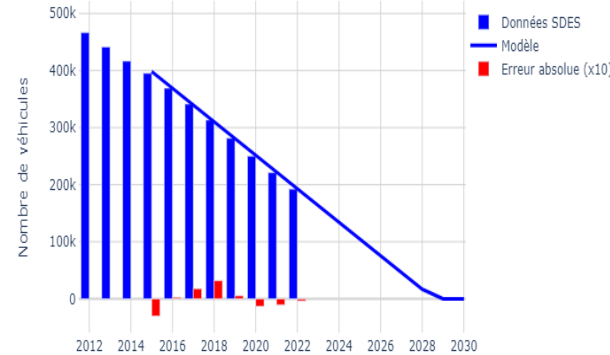
Paris

Ile-de-France

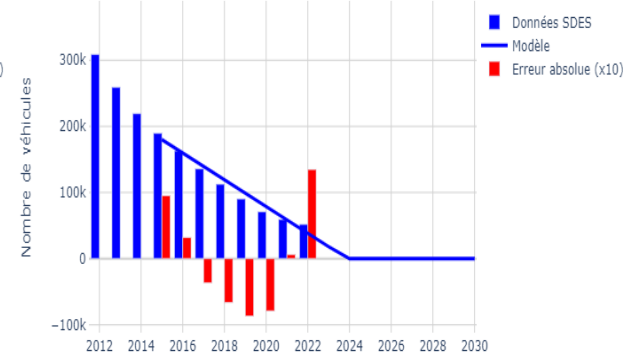Estimation des véhicules Essence Crit'Air 1 de 2023 à 2030 (MGP)

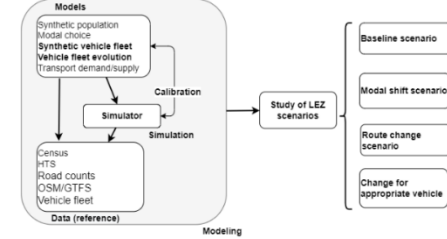Estimation des véhicules Essence Crit'Air 2 de 2023 à 2030 (MGP)

Estimation des véhicules Essence Crit'Air 3 de 2023 à 2030 (MGP)

Estimation des véhicules Essence Non classé de 2023 à 2030 (MGP)

LEZ SCENARIOS DESCRIPTION

- **Scenario1: Baseline scenario (reference)** ✓
  - Without any LEZ configuration
  - 5% of IdF population
  - Vehicle Fleet 2024, 2027, 2030

- **Scenario2: Modal shift** ✓
  - Based on reference scenario
  - Remove no appropriate vehicles
  - Force these owners to switch to other modes of transport, in particular public transit
 - Focus on the ability of PT supply to meet this additional demand

- **Scenario3: All vehicles respect the LEZ rules**
  - Based on reference scenario
  - Change no appropriate vehicles for those with good criteria
  - Focus on fleet renewal rate

- **Scenario4: Route change**
  - Based on reference scenario
  - Force no appropriate vehicles owners to change their routes for avoiding the LEZ
  - Focus on the reported impacts in the neighborhood

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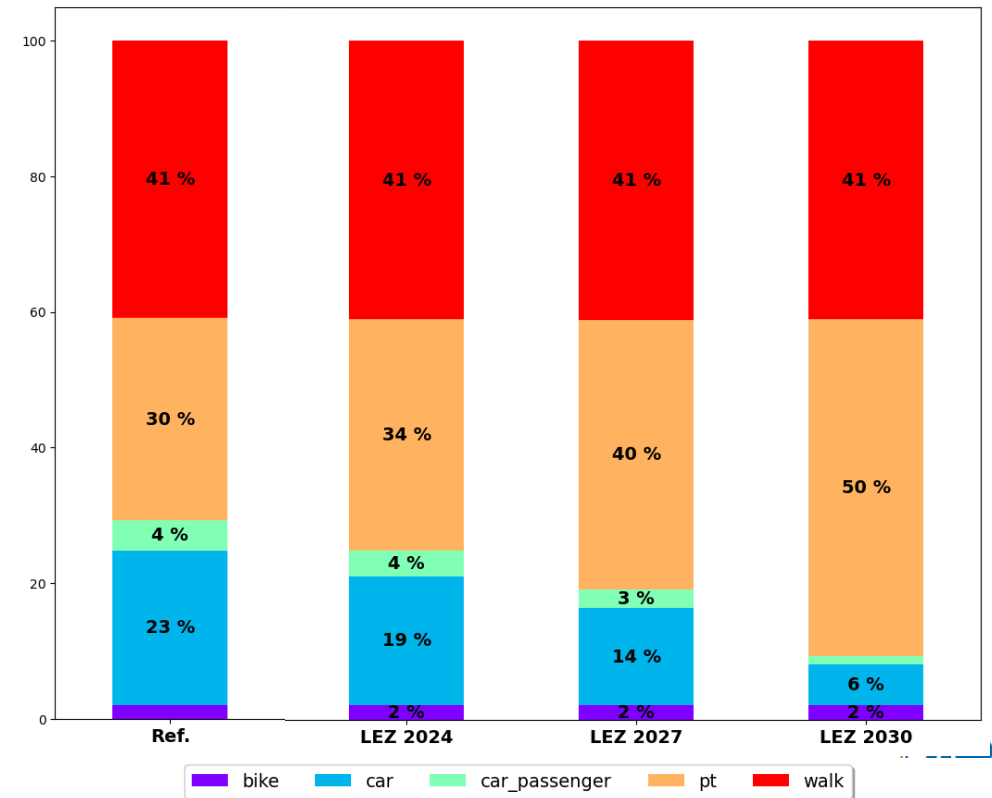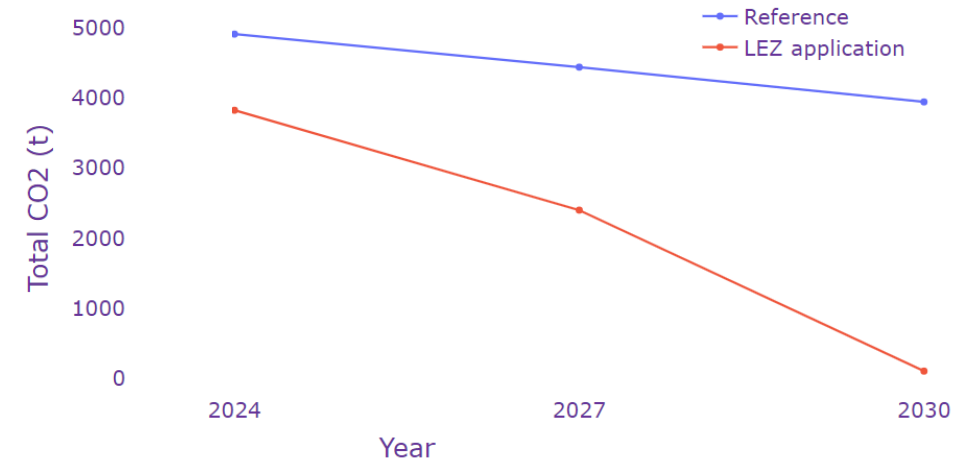- **Results**
- Conclusion and perspectives

STUDY AREA DESCRIPTION
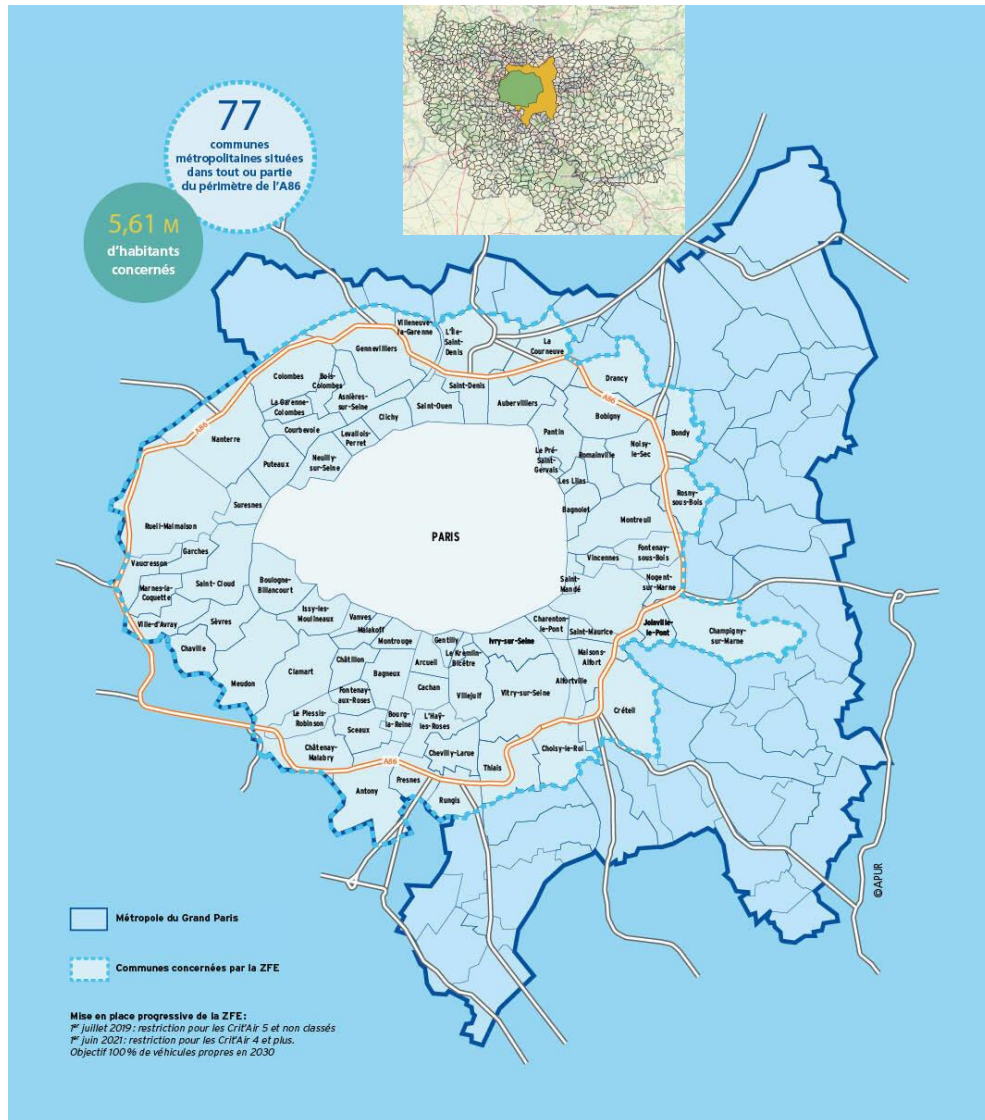
- **Simulation area: Ile-de-France with 5% population**
- **Analysis focuses on Grand Paris:**
  - **131 municipalities (including Paris)**
  - **Low emission zone (ZFE)** from 2024 to 2030 ➜ 77 municipalities around A86
  - **Walking** is the primary transportation mode with **42%**, followed by **public transit (28%)**, **car (28%)**, and **bike (2%)** (*source EGT 2010*)

MODAL SHIFT SCENARIO

- Reference scenario vs modal shift scenario
- Reference scenario:
  - without any LEZ consideration
  - car fleet evolution:
    - 2024
    - 2027
    - 2030
- Modal shift scenario:
  - Population with no appropriate vehicles switches to public transport
  - Public transport supply
  - Accessibility of public transport

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CONCLUSION & PERSPECTIVES

● Ongoing work:
- ● Reference and modal shift scenario
- ● Analysis of PT supply

● Future works:
- ● Improve the **agent vehicle fleet generation (based on the income, socioeconomic attributes etc…) and the evolution of the population**
- ● Run the other projected scenarios
- ● **Combined scenario:**
  - ● **Modal shift + Car fleet renewal + Route change**

THANK YOU FOR LISTENING!

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