

# URBAN SCALE AIR QUALITY ASSESSMENT WITH A HARMONIZED MULTI-SCALE MODEL

*Valentina Agresti<sup>1</sup>, Andrea Amicarelli<sup>1</sup>, Guido Pirovano<sup>1</sup>, Anna Toppetti<sup>1</sup> and Andrea Piccoli<sup>2</sup>*

<sup>1</sup> Sustainable Development and Energy Sources Department, RSE Spa, Milano, Italy

<sup>2</sup> Department of Civil and Environmental Engineering, Politecnico di Milano, Milano, Italy



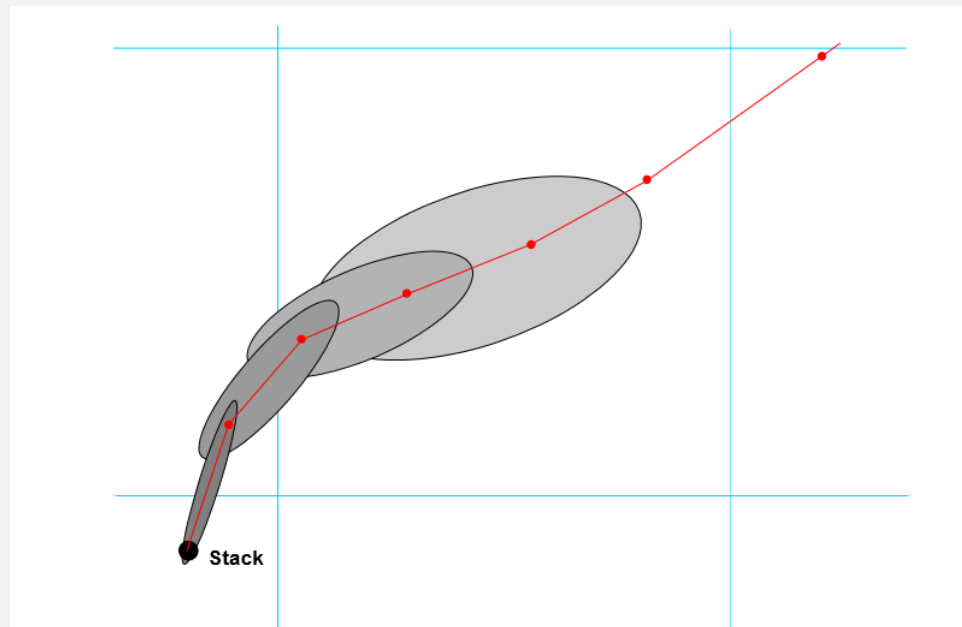
**POLITECNICO**  
MILANO 1863

# Overview

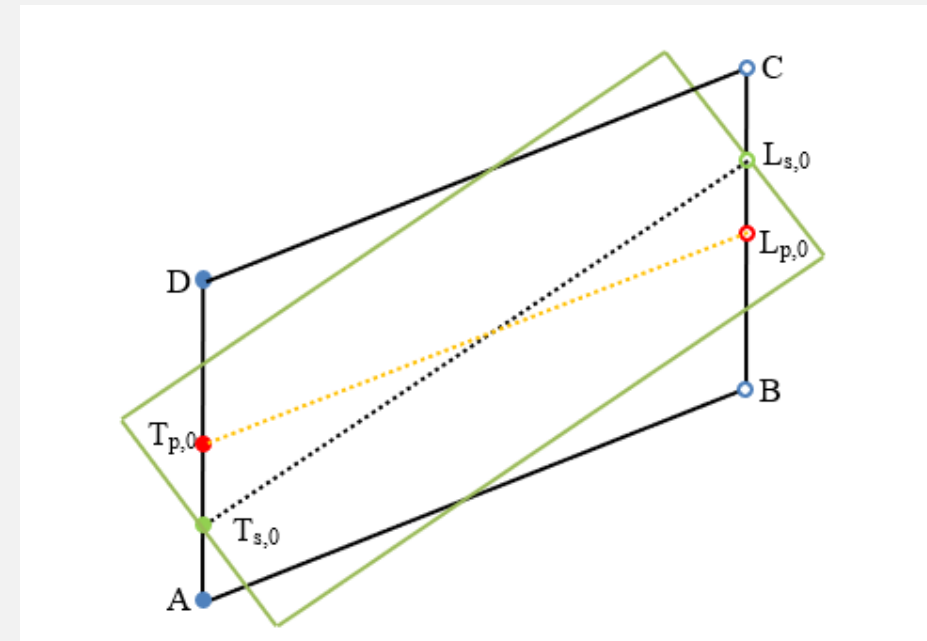
1. Motivation
2. Introduction
3. Modelling Setup
4. Study Area
5. Method
6. Results
7. Conclusion

# Motivation

The **CAMx Plume-in-Grid (PiG)** sub-model addresses the size and chemical evolution of point source plumes (*Stacks*)



We develop a **CAMx Linear Plume-in-Grid (LPiG)** sub-model to represent linear emission source (*Roads*)



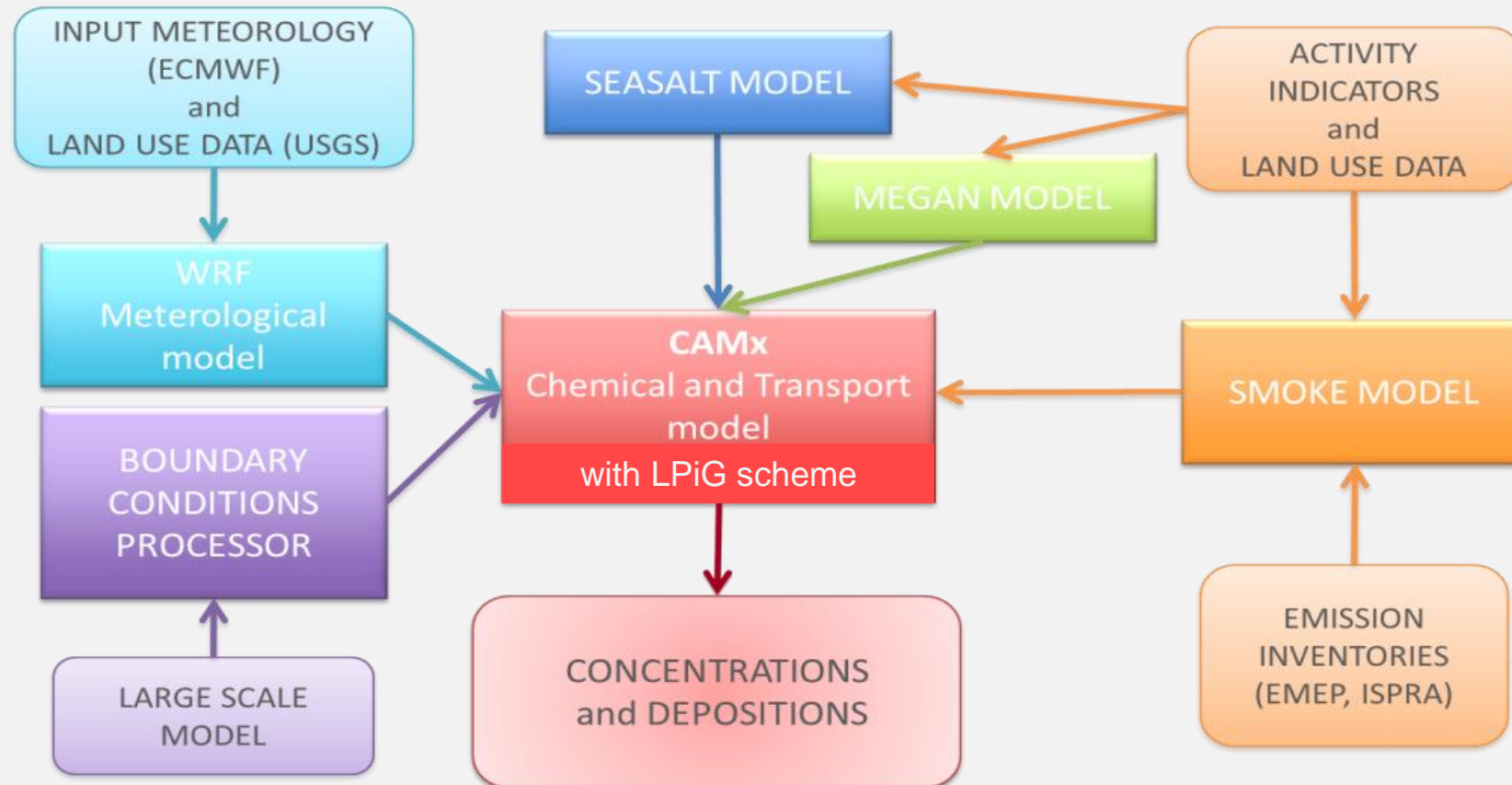
# Introduction

- The Po Valley basin and the city of Milan are affected by poor air quality that is very harmful to the local population.
- At urban scale, representing accurately road traffic emissions and concentrations with models is very crucial to assess mobility policies.
- The Linear Plume in Grid (LPiG) scheme in CAMx model is developed to represent road traffic emissions explicitly as linear sources.

With respect to Hybrid Modelling Systems (HMS), CAMx-LPiG:

- Is designed to be fully consistent with the Eulerian host model and it does not require any ad-hoc treatment of source double counting.
- Takes advantage of the chemistry scheme available in CAMx, being therefore able to simulate also reactive compounds through a detailed and consistent chemical pathway.

# Modelling Setup



# Study Area

CAMx-LPiG scheme is applied in an urban domain (URB) over the city of Milan.

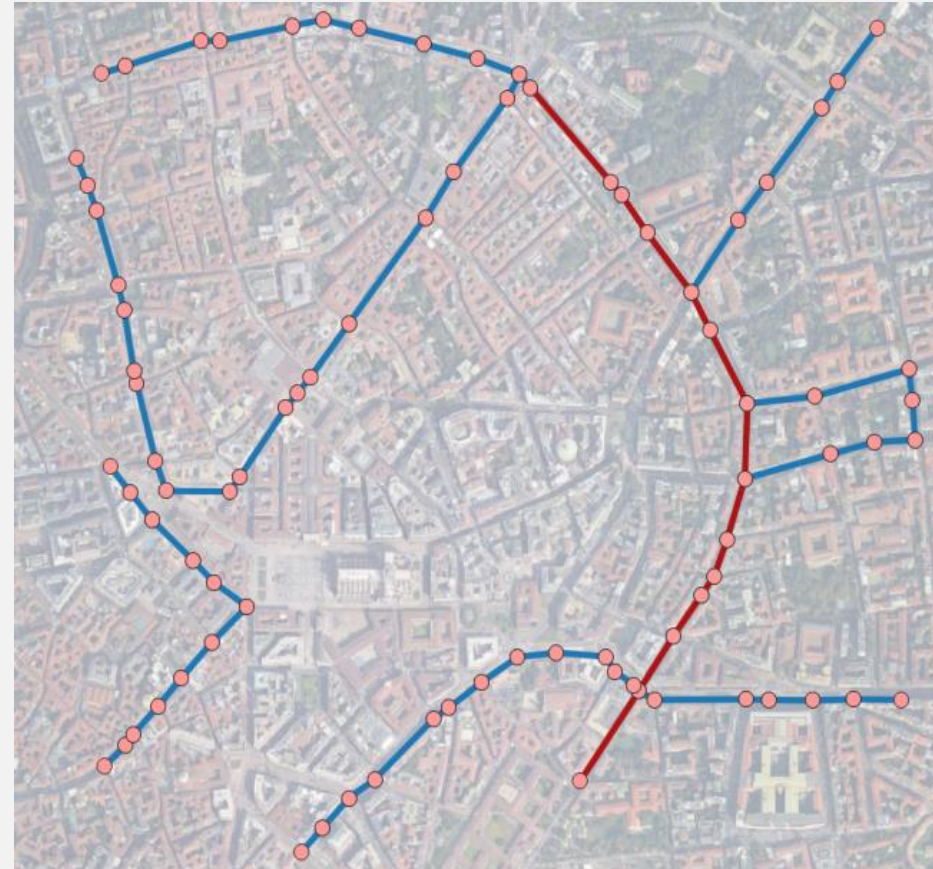
- URB domain spans over a 1.7 x 1.7 km grid cell of the metropolitan domain (MIL).
- MIL domain is nested in POV domain (Po Valley – 5 km of resolution)
- POV domain is nested in ITA domain (Italy – 15 km of resolution)



# Study Area

- The sampling grid in which CAMx-LPiG scheme is implemented has 50 m of resolution;
- The reference Milan city road network used is developed by the Mobility Environment and Territory Agency (AMAT).
- 82 of the main streets inside the URB domain are simulated with CAMx-LPiG scheme.

URB



# Method

- Road transport emissions simulated with CAMx-LPiG scheme include cars, mopeds, light and heavy vehicles;
- Hourly emissions associated with each road are calculated assuming that the larger is the road, the higher is the emission;
- Road transport emissions are split between the 82 modelled roads and the remaining URB domain. 22% of the URB domain's road transport emissions are simulated within CAMx-LPiG scheme.

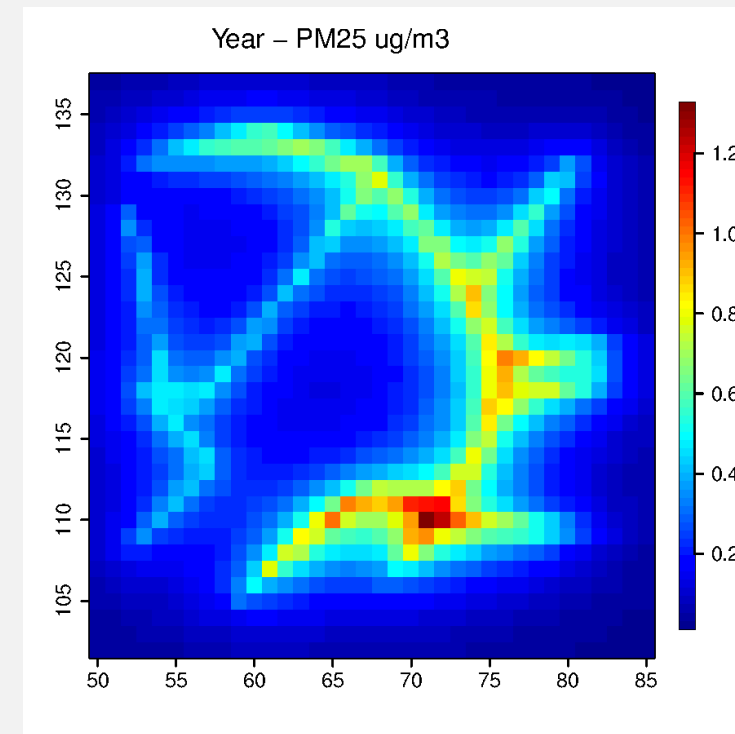
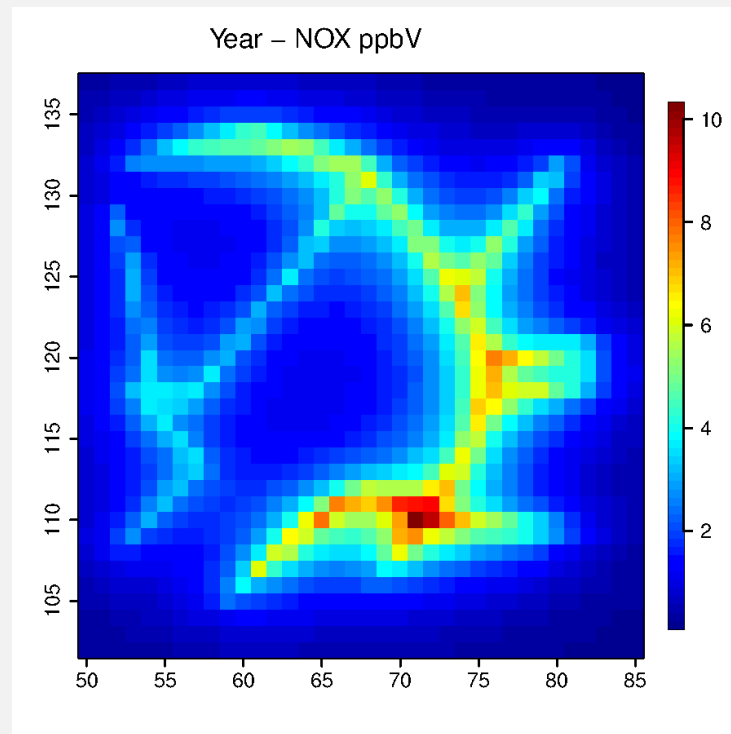


# Results (1/3)

Two yearly simulations with CAMx model are performed (year 2010).

1. CAMx-LPiG Only (CLO): only LPiG scheme is activated without background concentration;

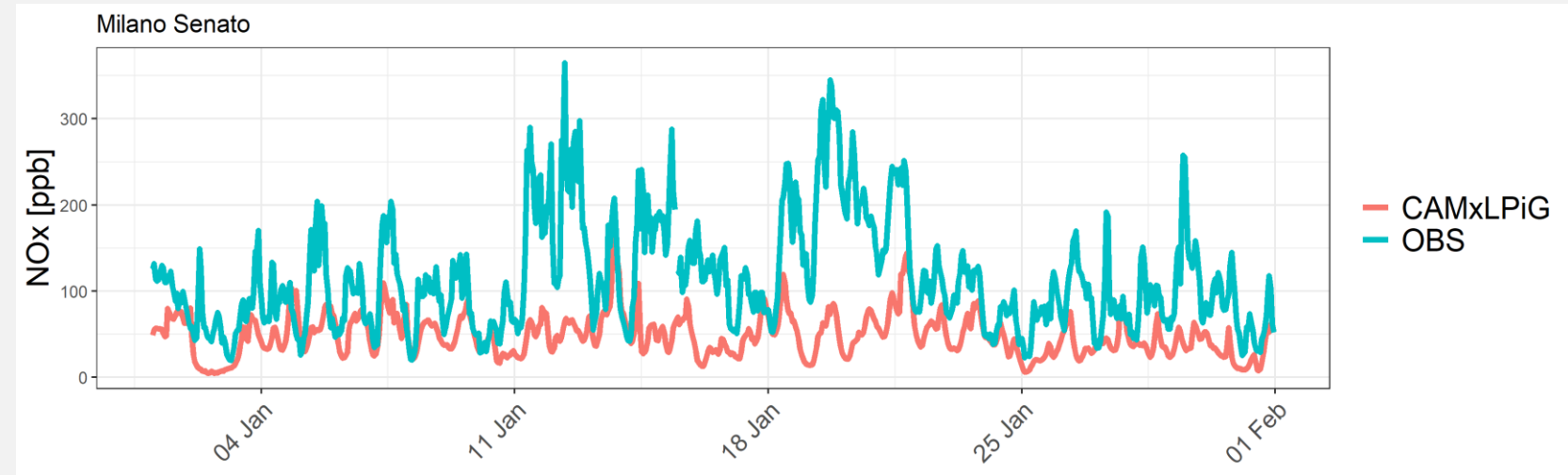
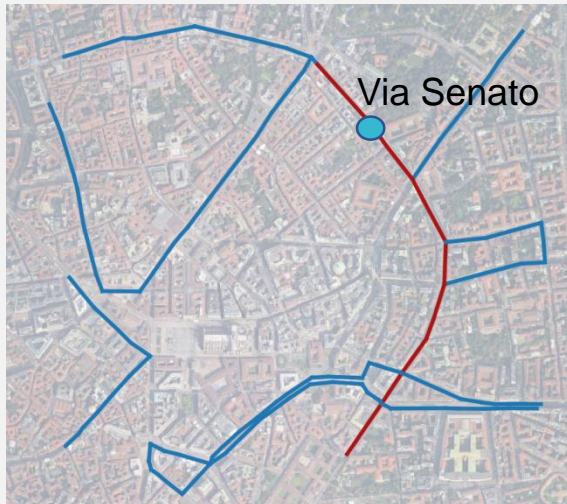
→ Aimed at verifying the correct representation of the road network with the CAMx-LPiG scheme.



# Results (2/3)

2. CAMx-LPiG Background (CLB): both CAMx-LPiG and background concentrations are considered.

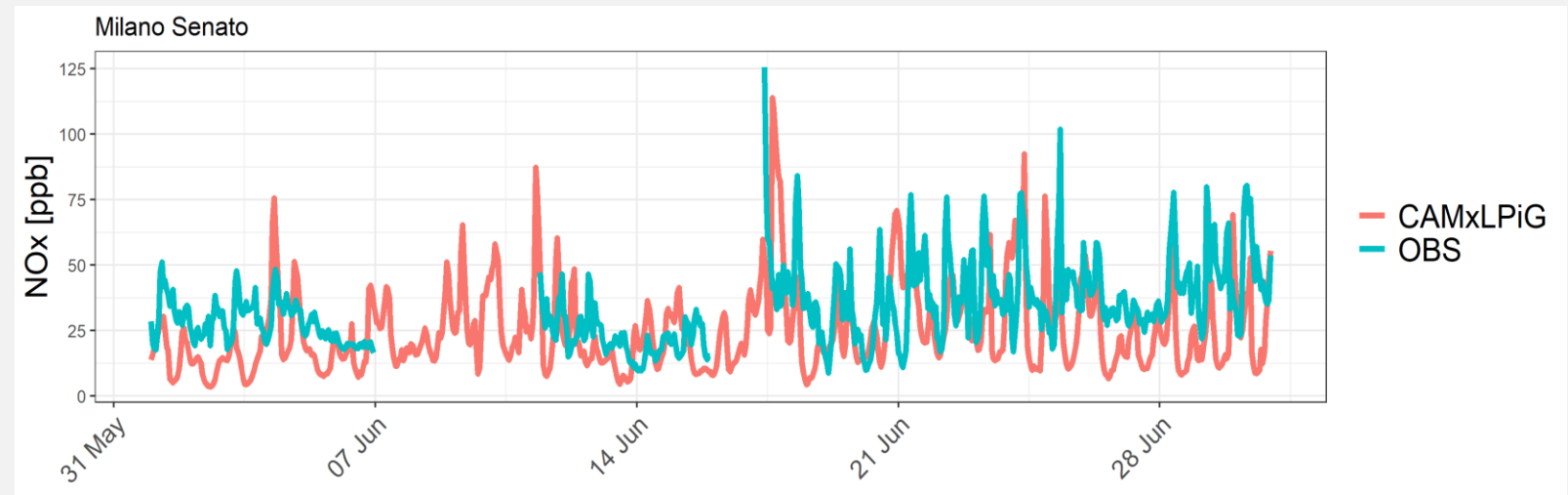
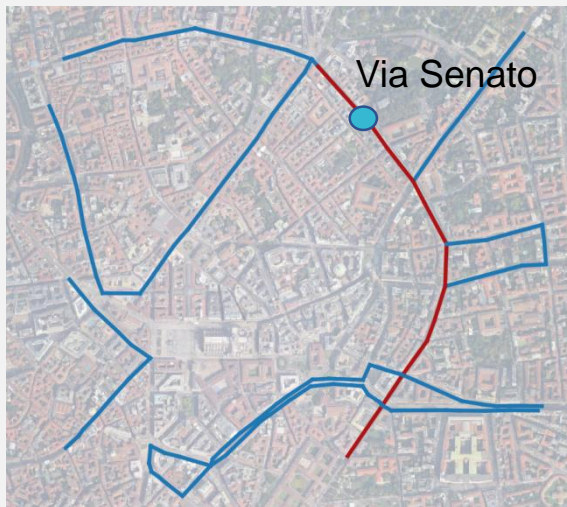
➔ Aimed at calculating the actual concentration fields and to validate them with observed values.



# Results (3/3)

2. CAMx-LPiG Background (CLB): both CAMx-LPiG and background concentrations are considered.

→ Aimed at calculating the actual concentration fields and to validate them with observed values.



# CONCLUSIONS

With respect to HMS:

- The coupling of CAMx-LPiG allows to estimate multi-scale pollutant concentration fields using the same physical parameterizations and chemistry scheme.
- CAMx-LPiG allows flexibility in modelling a specific road network, fitting easily the specific mobility policy we need to assess.
- Further calibrations are needed so that the concentration values could be more and more consistent with the observed values.

Thank  
You!