Topic 1: Model evaluation and quality assurance – model validation, model intercomparisons, model uncertainties and model sensitivities

TRAFFIC EMISSION SIMULATION AND VALIDATION WITH MEASURED DATA IN SOUTH KOREA

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OUTLINE

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   2.3. Microscale traffic emission estimation
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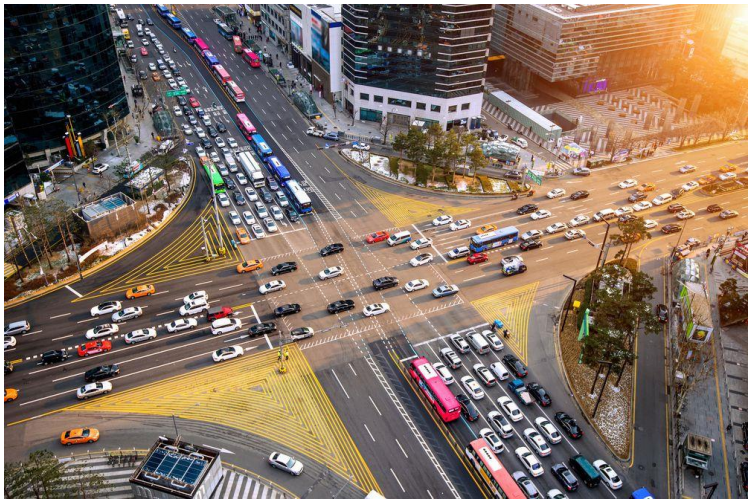
INTRODUCTION

- Road traffic → main factor affecting the air quality of big cities around the world
- In urban hot-spot road traffic is the most significant contributor to air pollution

Skyline from South Korean city. *Yonhap*

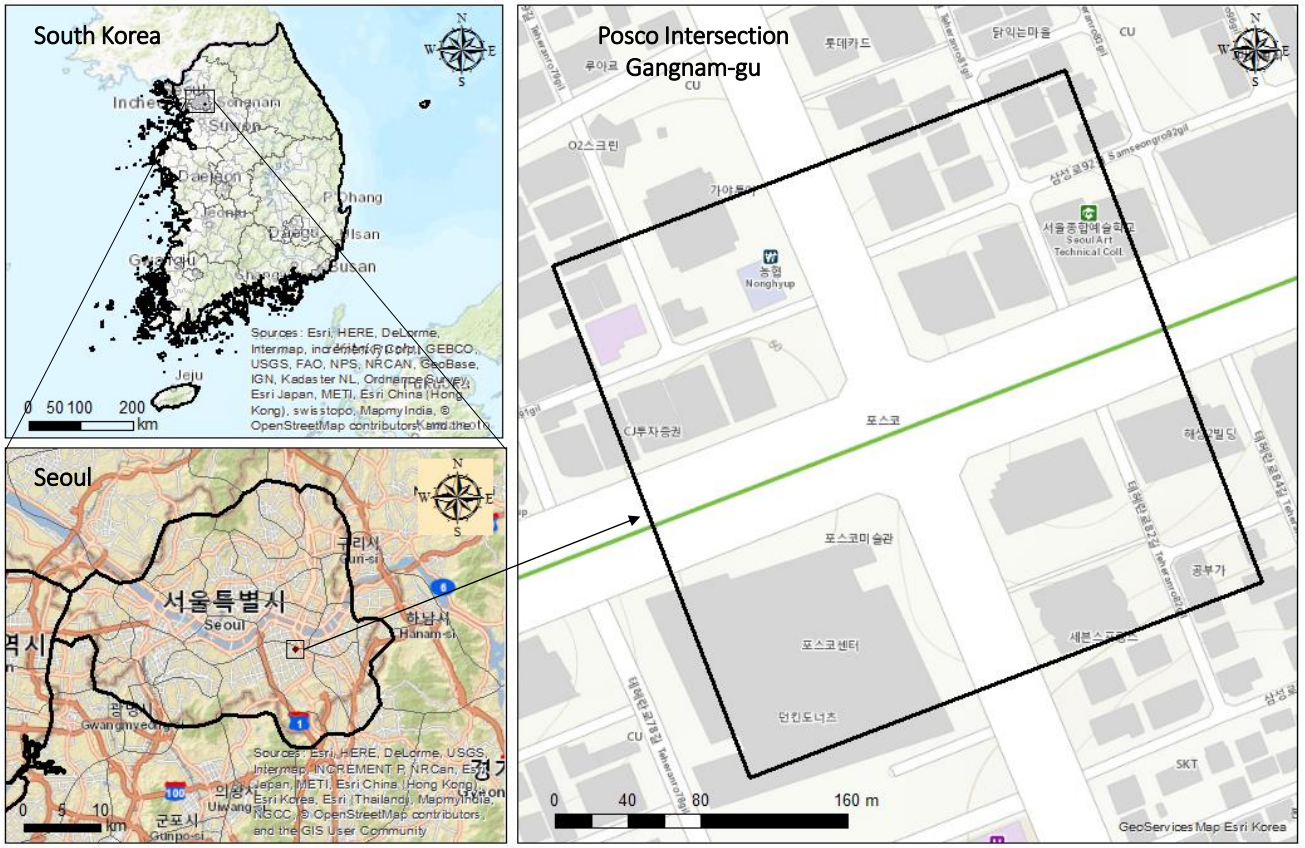


Intersection in Gangnam, district of Seoul, South Korea. *Shutterstock*

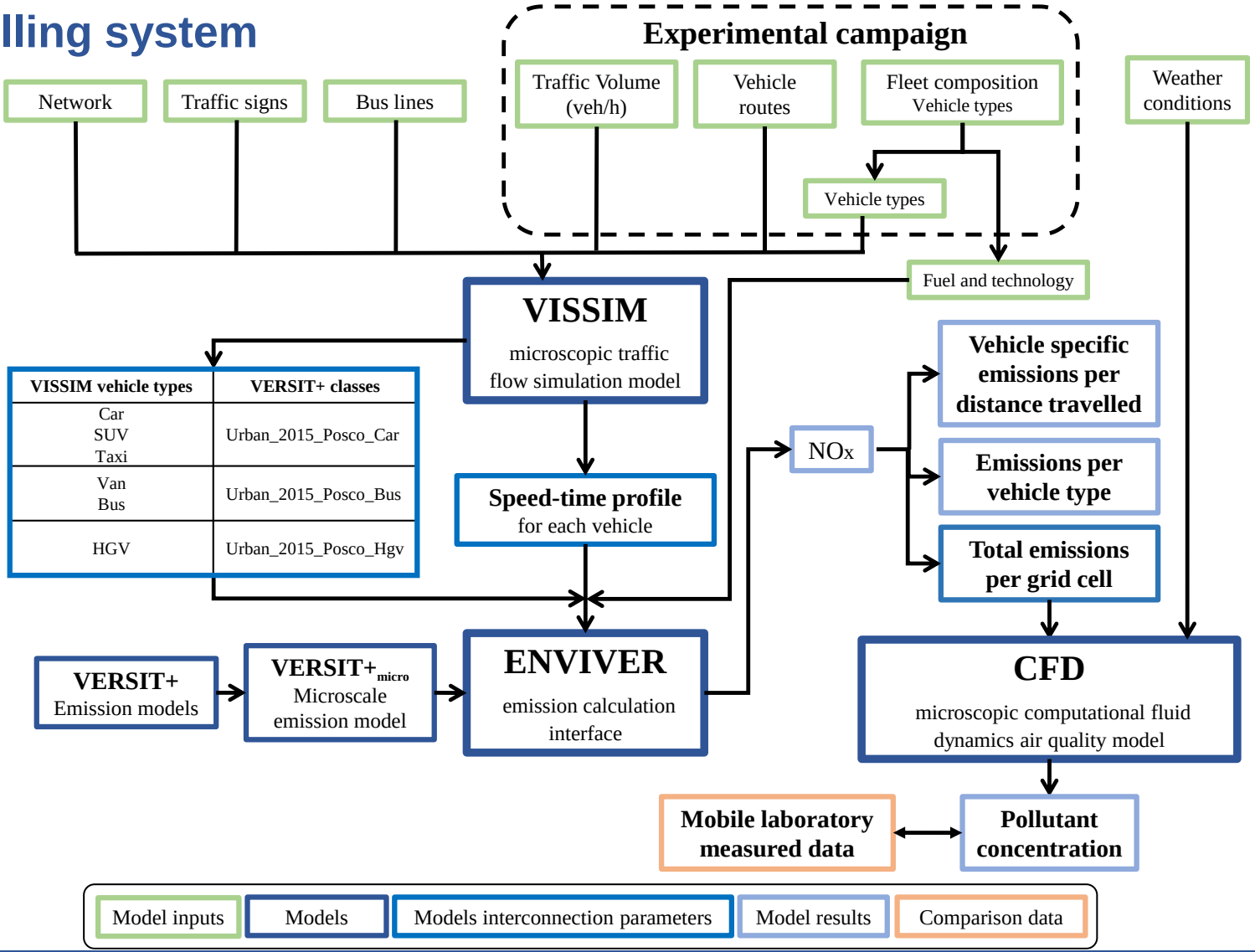
- Tendency to more accurate answers for specific air quality issues in cities
- Information for validation of this microscale approaches is scarce
- Motivation: first approach to the validation of VISSIM-VERSIT+$_{micro}$/ENVIVER modelling system with measured data to compute accurate traffic emissions

Modelling domain: POSCO intersection

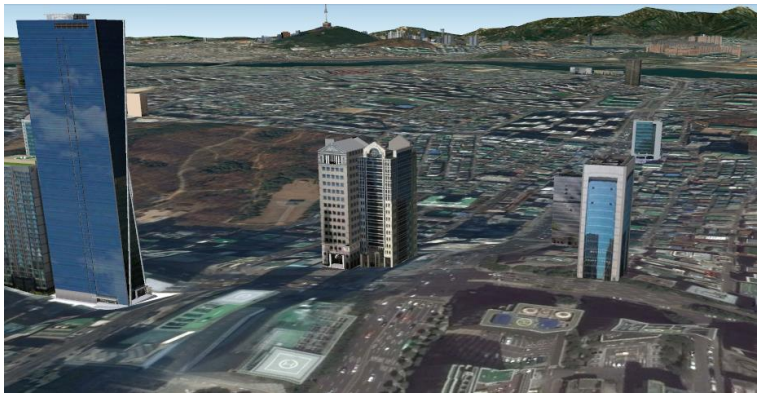
- 300m x 300m domain covering the intersection of 2 major roads: Teheran and Samseong
- More than 8000 veh·h^{-1} crossing the signalized intersection at peak hours
- 2 scenarios: 9:00 - 10:00 a.m. (peak) and 15:00 - 16:00 p.m. (off-peak)



Modelling system



Microscale traffic simulation with PTV VISSIM



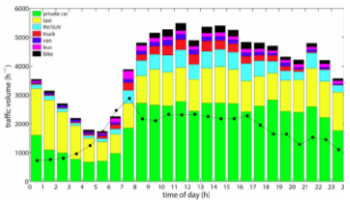
Real world

Static traffic data

Bus lines and stops

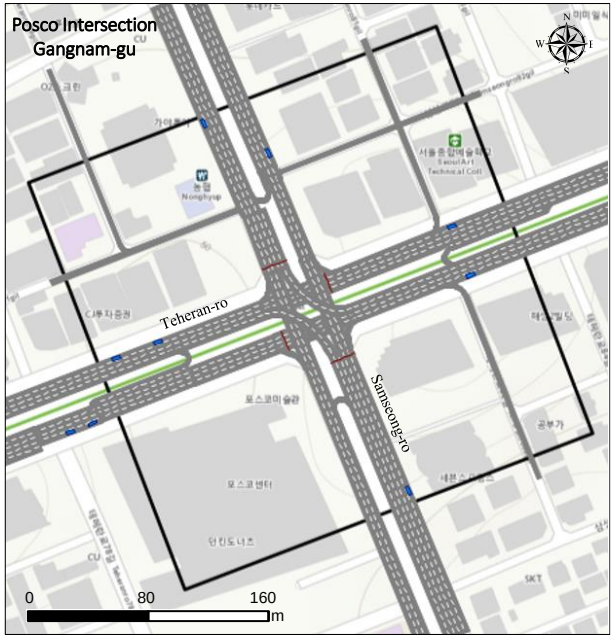
Position of traffic lights and phases

Dynamic traffic data



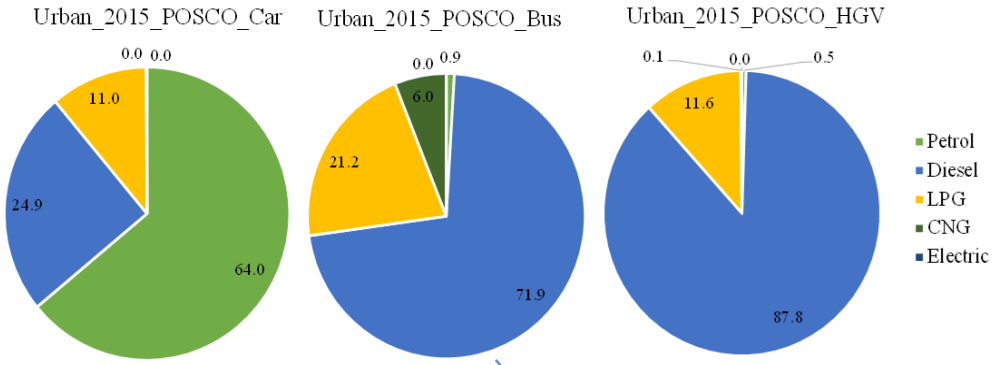
Traffic volume, routes and composition

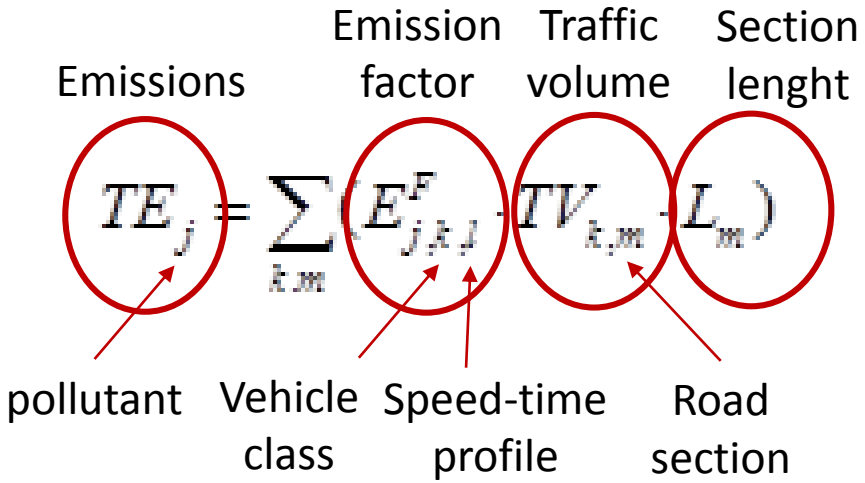
20 links
27 connectors
4 signal heads
9 bus stops
24 bus lines



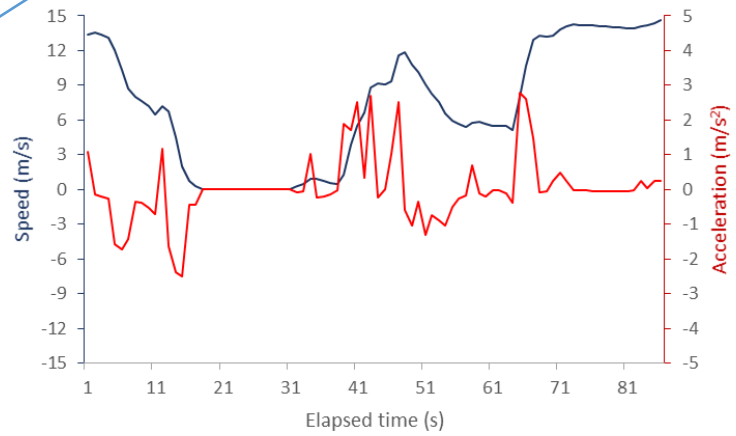
Scenario simulation

Emission calculation with TNO Versit+micro/Enviver

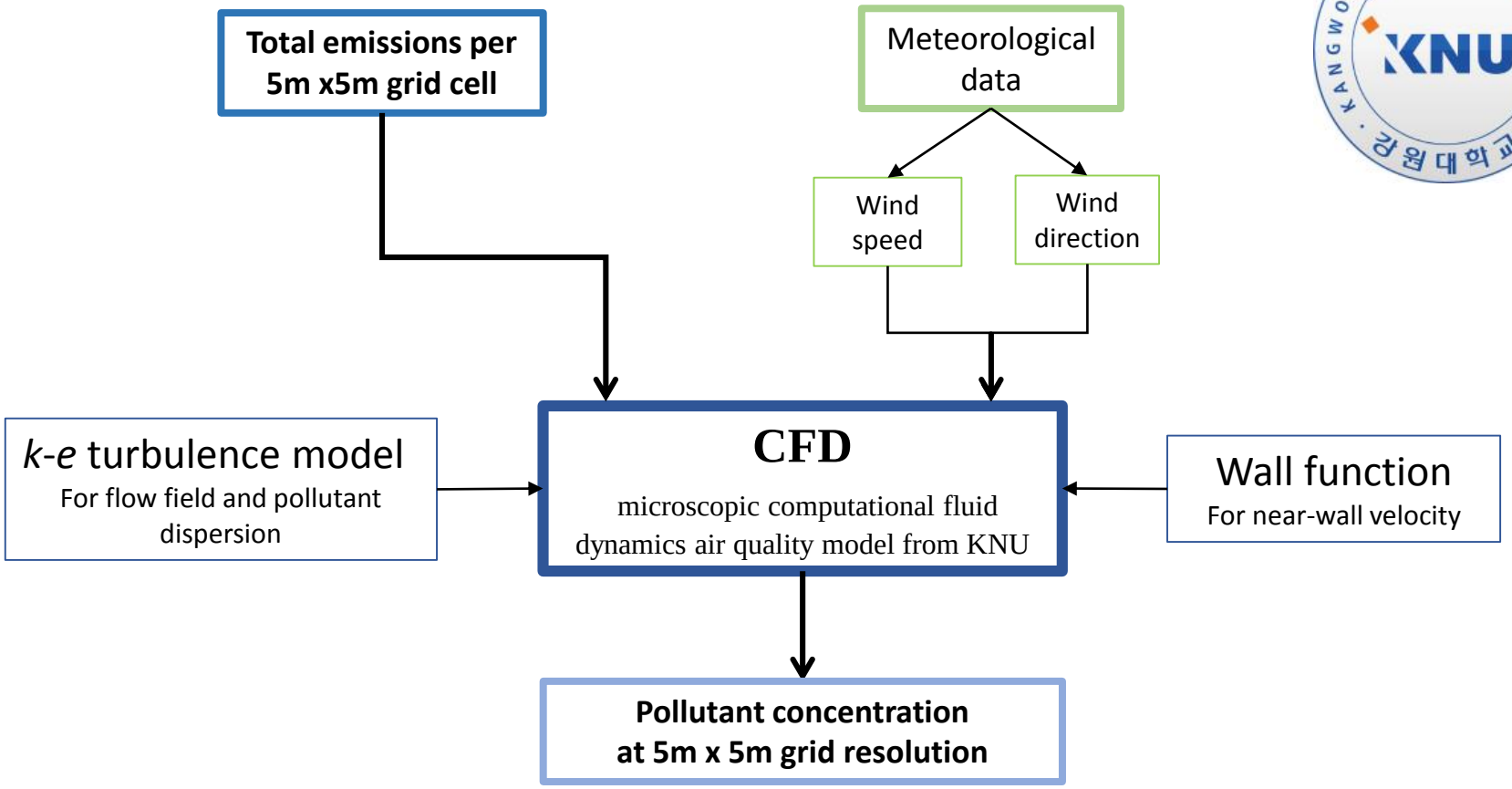




Area	Road type	VISSIM customized classes	VERSIT+ customized vehicle class name
Posco	Urban	Car	Urban_2015_Posco_Car
		Taxi	
		SUV	
		Van	Urban_2015_Posco_Bus
		Bus	
		HGV	Urban_2015_Posco_HGV
		Bike	Not assigned



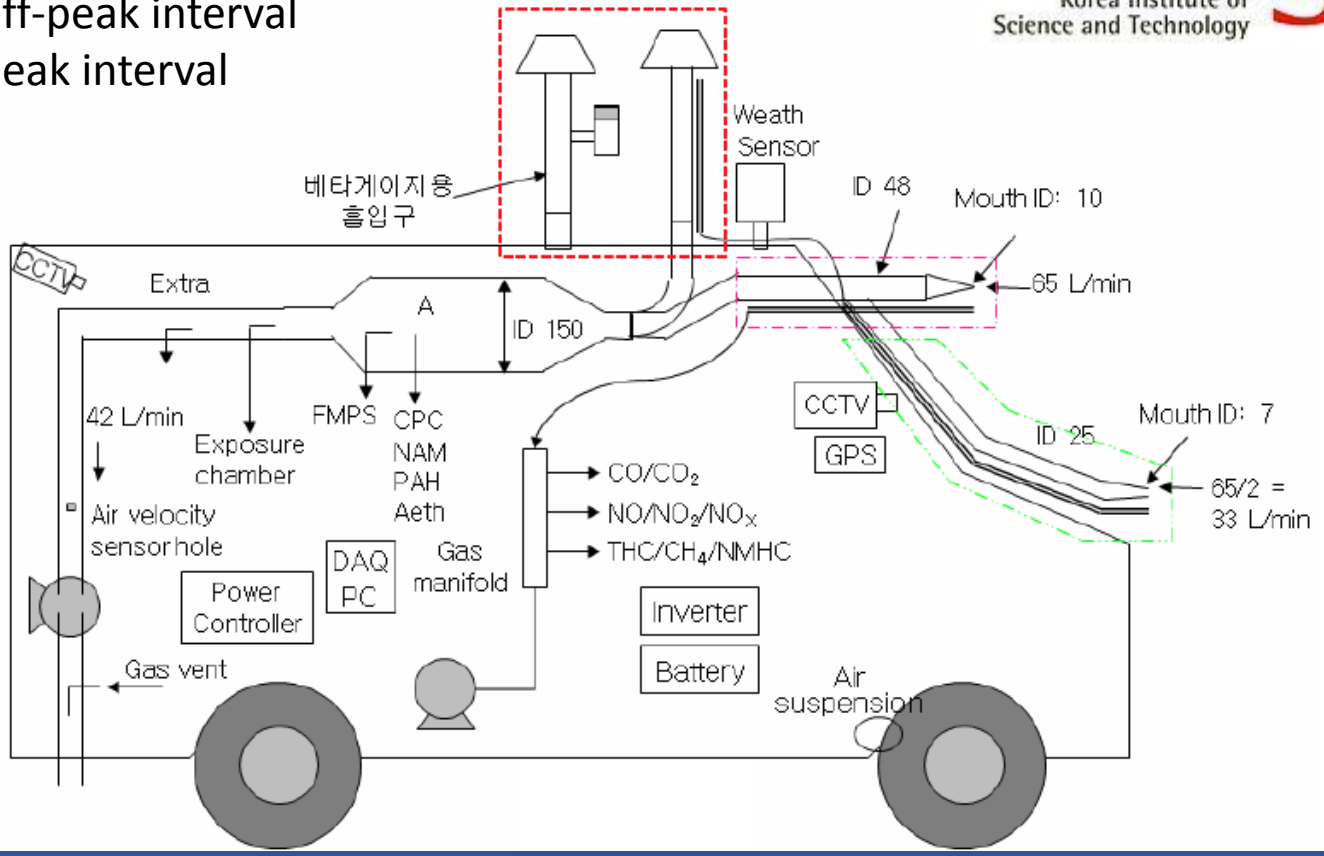
CFD pollutant concentration modelling



More information: Kwak et al. 2015

KIST Mobile laboratory data recompilation

- NO_x measurement (calibration before and after)
- GPS location
- Sampling height 2m
- 4 trips for off-peak interval
- 6 trips for peak interval



More information:
- Kim et al., 2014
- Woo et al., 2016

RESULTS AND DISCUSSION

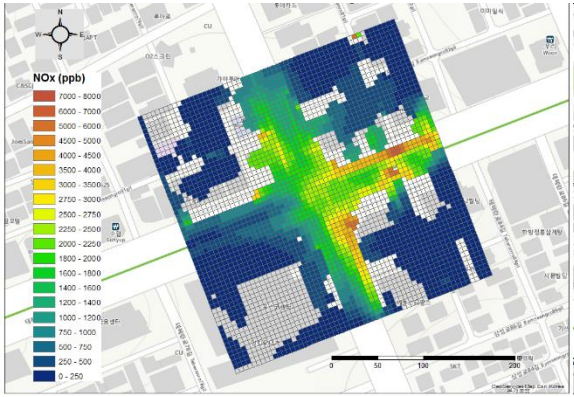
Traffic emissions from the VISSIM-VERSIT+micro/ENVIVER

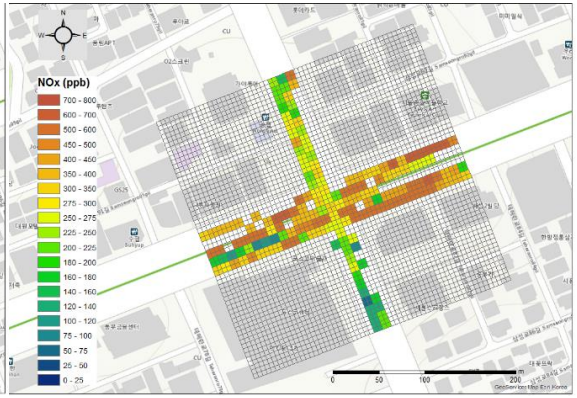
Concentrations from the **CFD** model

Concentrations measurements from the **Mobile Laboratory**

Peak

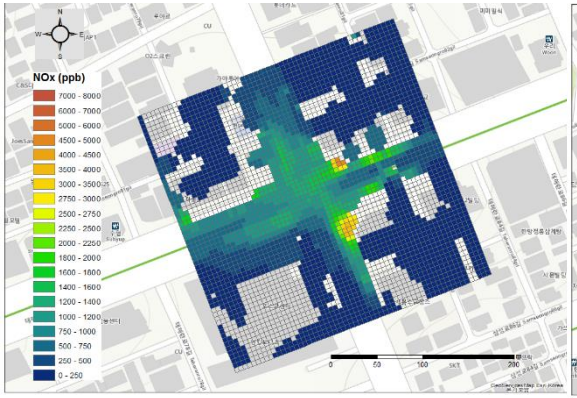
7780.4 g·h^{-1} (2.34 g·km^{-1})

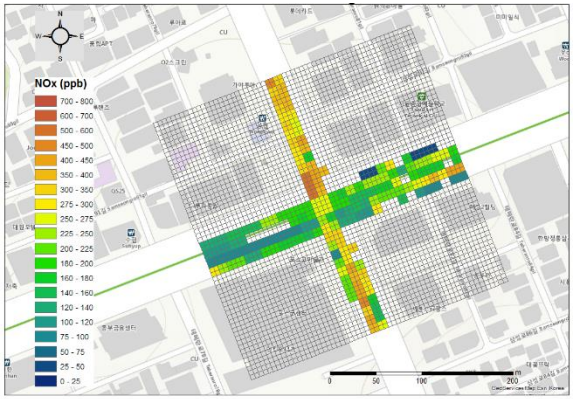




Off-Peak

5074.6 g·h^{-1} (1.86 g·km^{-1})





CONCLUSIONS

- First attempt to the validation of the VISSIM-VERSIT+$_{micro}$/ENVIVER modelling system on a real hot-spot using ML data (observations)
- Simulated concentration results are hard to compare to ML measured data:
  - difficult to obtain individual trip data that covers the whole domain for a complete hour
  - comparison is extremely dependant of a correct location of measurements
- Spatial distribution maps present similar concentration patterns:
  - higher concentrations near to the intersection
  - queuing vehicles after traffic lights in main roads

NEXT STEPS

- High concentration levels predicted by the simulation system must be corrected in order to compare the results values directly to the on-road measured data
- Compare simulated emission data using inverse emission estimation from the on-road measured concentrations for emission validation purposes

Korea Institute of Science and Technology

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Thank you for your attention!

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