

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*

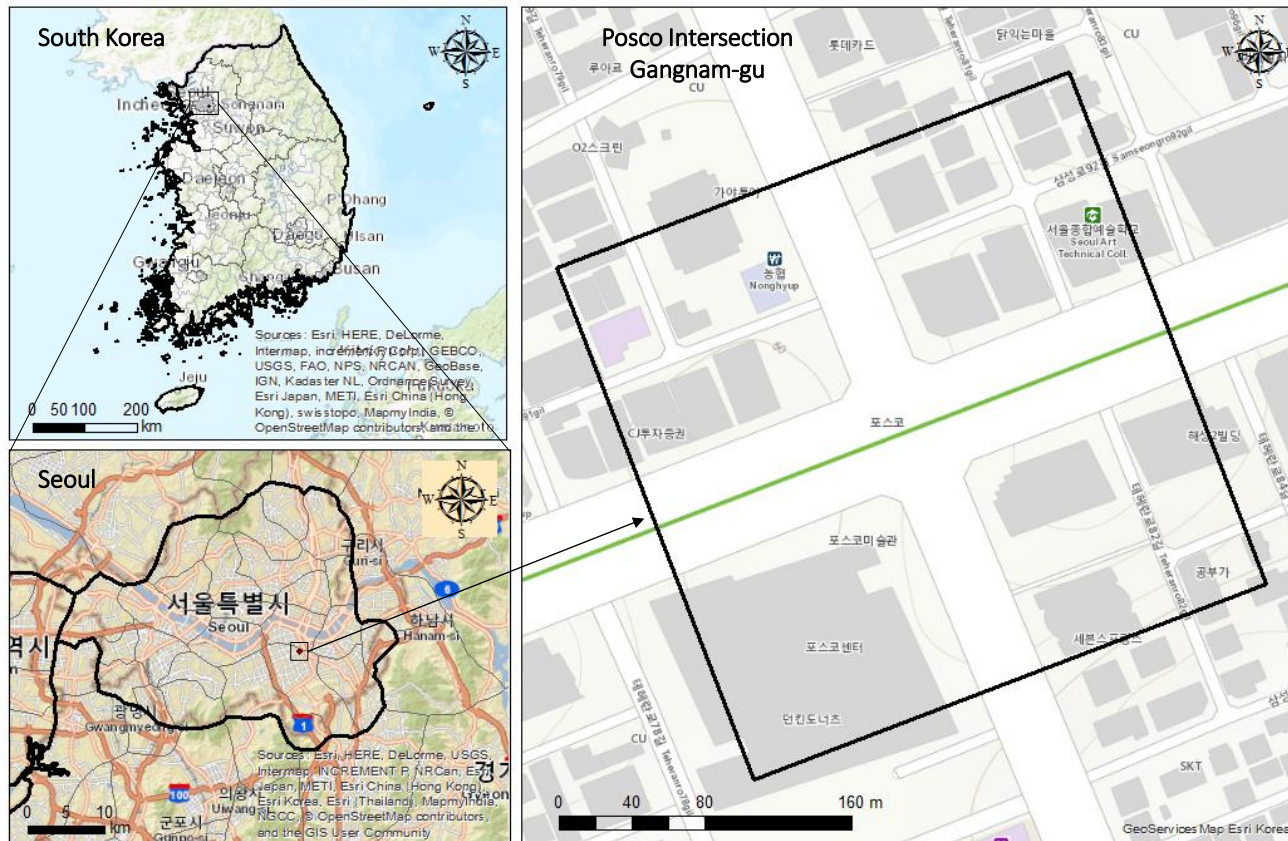


Intersection in Gangnam, district of Seoul, South Korea. *Shutterstock*

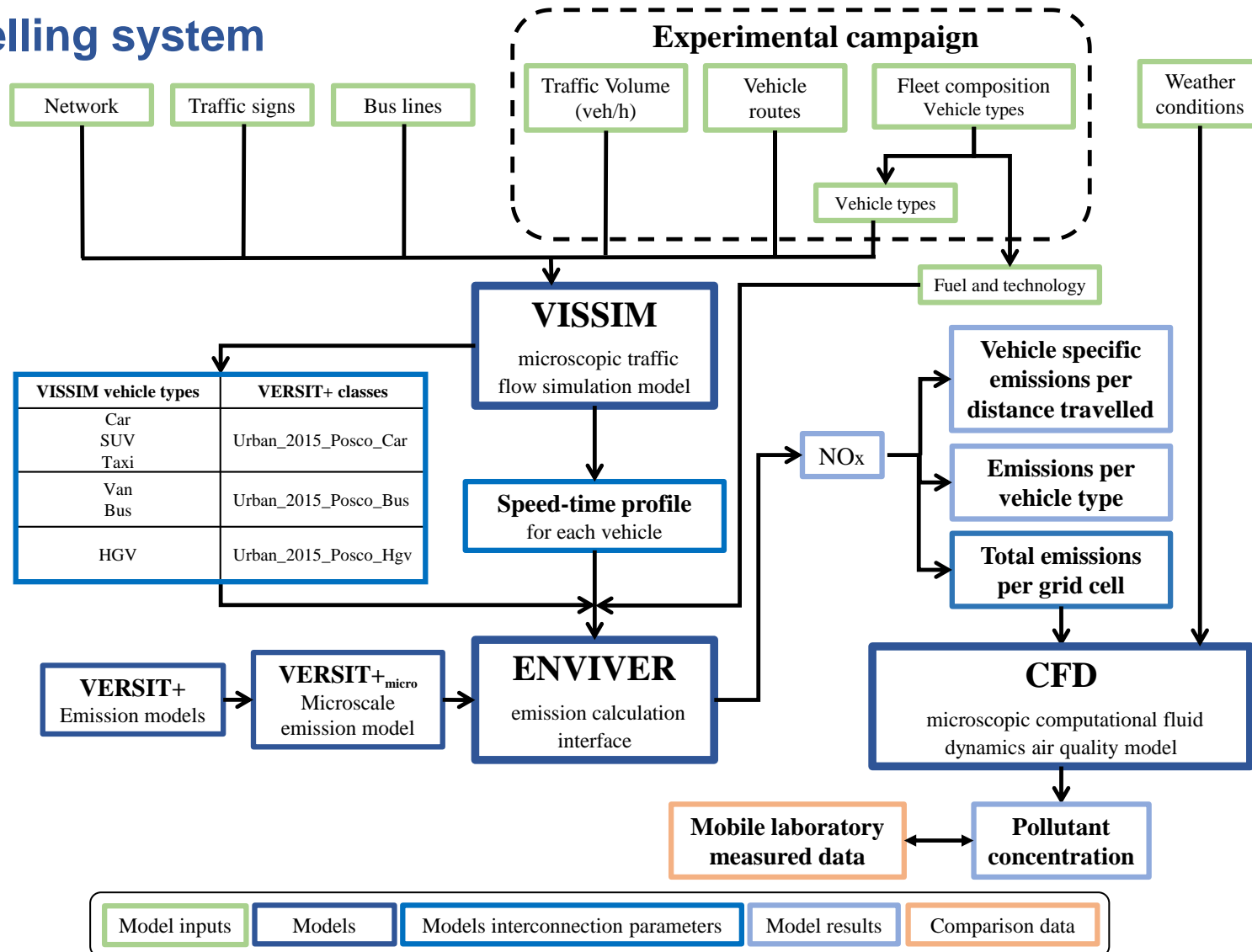
- Tendency to more accurate answers for specific air quality issues in cities
- Information for validation of this microscale approaches is scarce
- Motivation: first approach to the validation of VISSIM-VERSIT+_{micro}/ENVIVER modelling system with measured data to compute accurate traffic emissions

Modelling domain: POSCO intersection

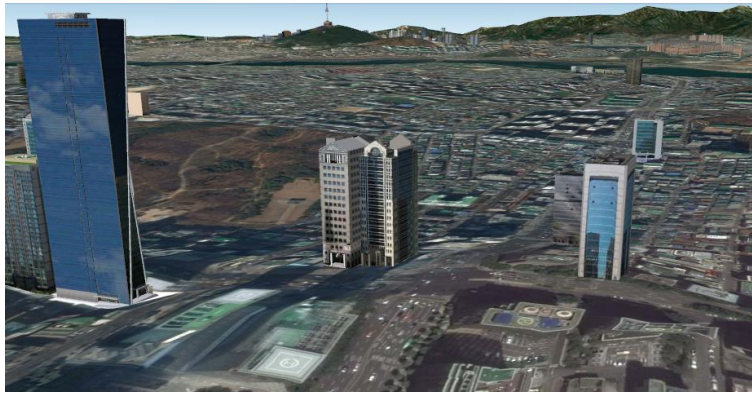
- 300m x 300m domain covering the intersection of 2 major roads: Teheran and Samseong
- More than 8000 veh·h⁻¹ crossing the signalized intersection at peak hours
- 2 scenarios: 9:00 - 10:00 a.m. (peak) and 15:00 - 16:00 p.m. (off-peak)



Modelling system



Microscale traffic simulation with PTV VISSIM



Real world

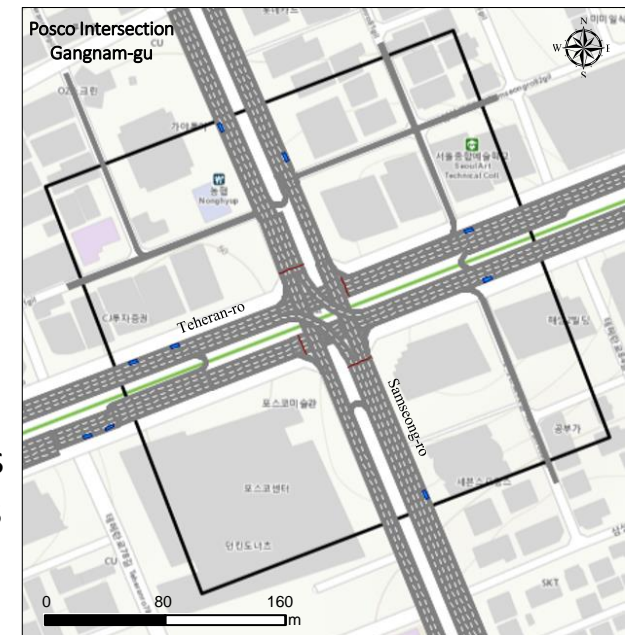
Static traffic data

Bus lines and stops Position of traffic lights and phases

Dynamic traffic data

Teheran-ro (NE)
Teheran-ro (SW)
Samseong-ro (SE)

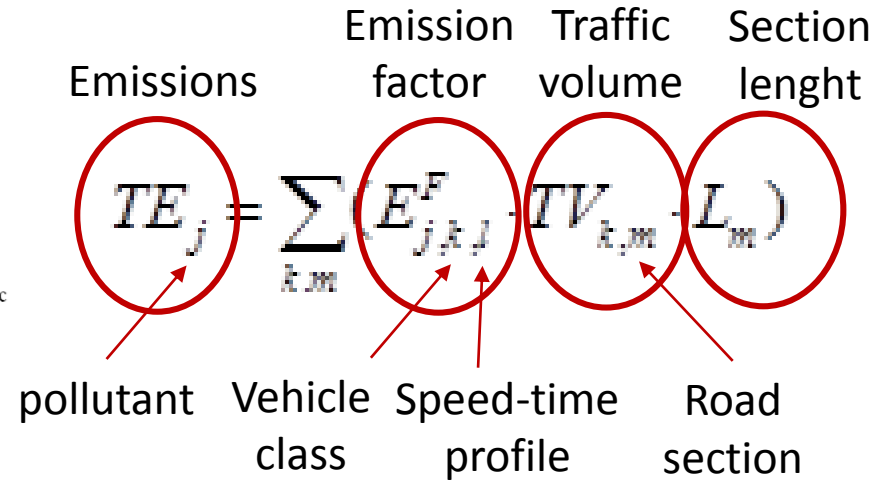
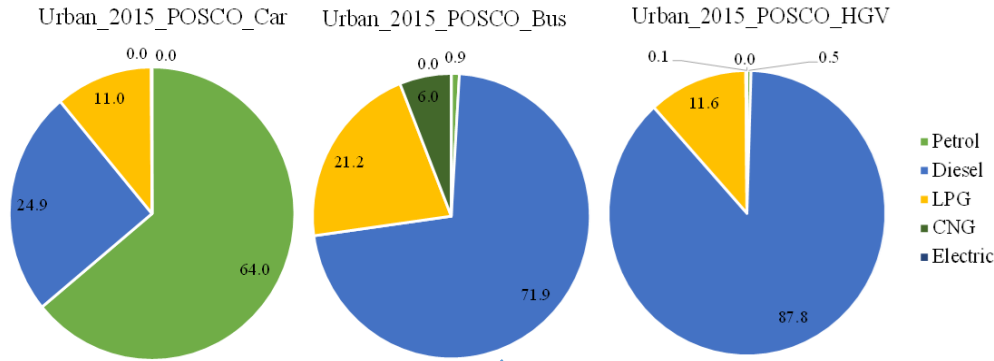
Traffic volume, routes and composition



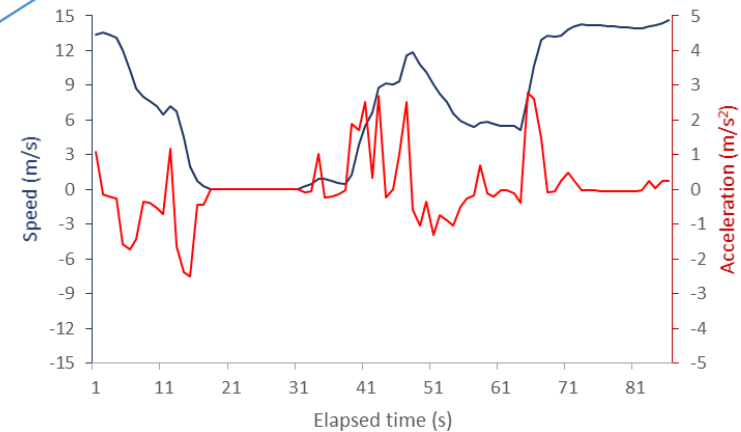
- 20 links
- 27 connectors
- 4 signal heads
- 9 bus stops
- 24 bus lines

Scenario simulation

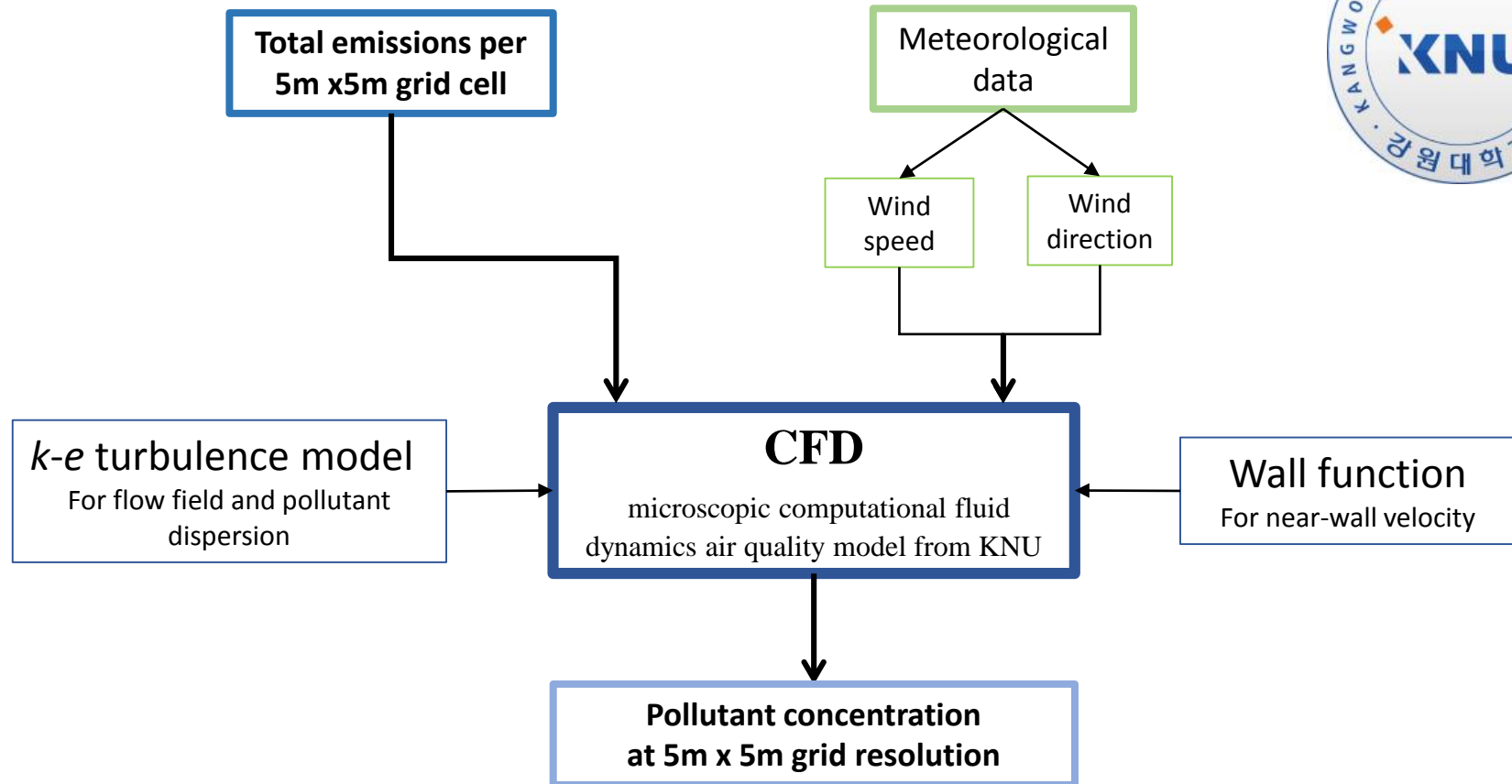
Emission calculation with TNO Versit+micro/Enviver



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

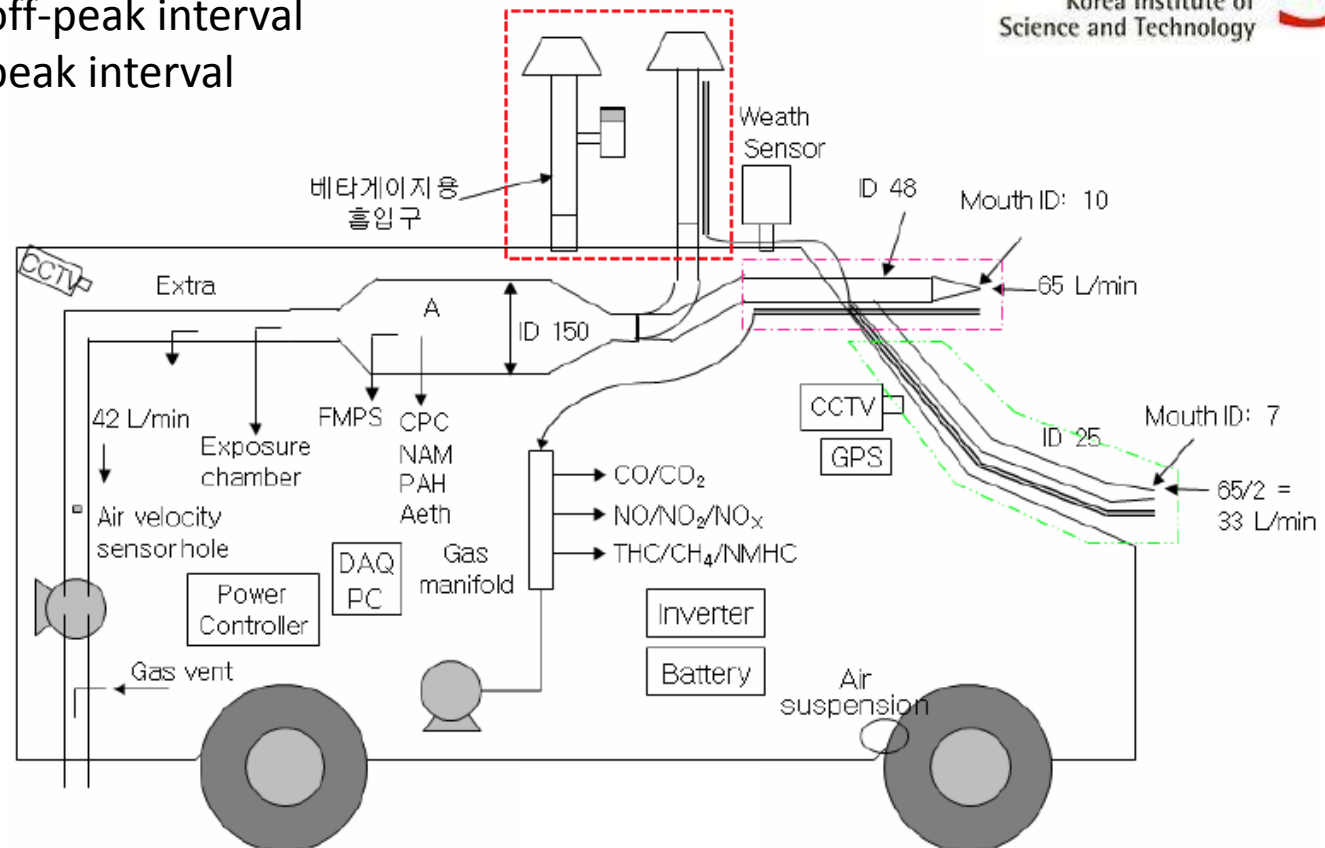


CFD pollutant concentration modelling



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

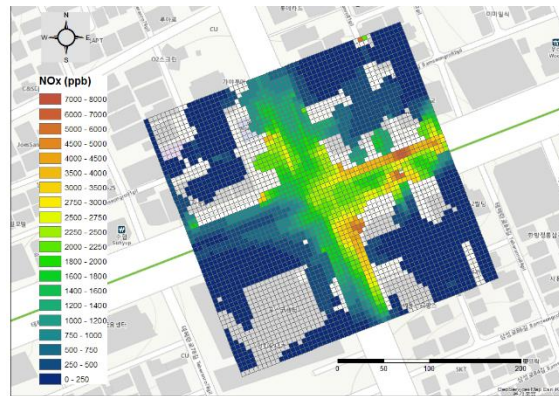
Traffic emissions from the
VISSIM-VERSIT+micro/ENVIVER

7780.4 $\text{g}\cdot\text{h}^{-1}$ (2.34 $\text{g}\cdot\text{km}^{-1}$)

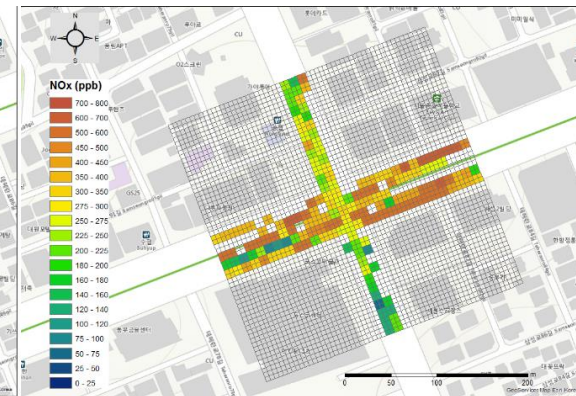


Peak

Concentrations from the
CFD model



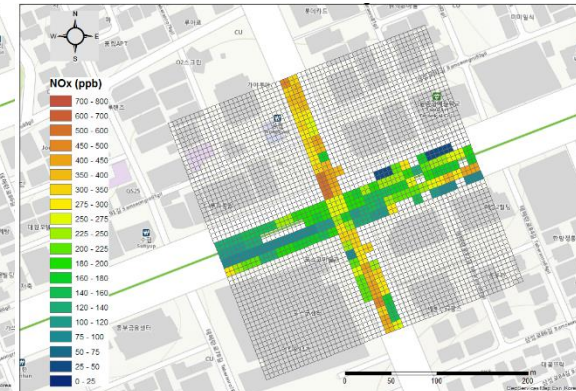
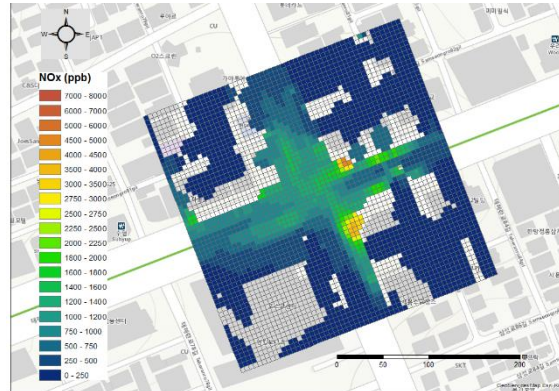
Concentrations
measurements from the
Mobile Laboratory



5074.6 $\text{g}\cdot\text{h}^{-1}$ (1.86 $\text{g}\cdot\text{km}^{-1}$)



Off-
Peak

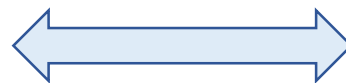


CONCLUSIONS

- 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



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- VISSIM and VERSIT+micro/ENVIVER were licensed by PTV Group and TNO

Thank you for your attention!

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