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FINNISH METEOROLOGICAL INSTITUTE

CBC 2014-2020
SOUTH-EAST FINLAND - RUSSIA

CBC Green InterTraffic – project meeting

29.-30.1.2019, Helsinki

Welcome to FMI

18.2.2019 **Emmi Laukkanen**

Agenda – Tuesday 29th Jan

10:00 Welcome to FMI - Emmi Laukkanen / FMI & Ludmila Karelina /SPCCI

10:30 *Coffee break*

11:00 Project Objectives: clarification for the first project phase

- Objectives of the Project; Tasks for the first project phase and the proposed distribution of the work for the first project phase among the project partners - Svetlana Vorontsova / Transport Intergration Ltd.
- Discussion

12:00 *Lunch*

13:00 Methodology for calculating emissions of greenhouse gases and other air emissions from vehicles using different types of fuel and energy

- In Finland Finland / Marko Torkkeli, LUT
- In Russia / Vladislav Pavlov / Transport Intergration Ltd

14:30 *Coffee break*

15:00 Air Quality modelling - CAR-FMI model and resuspension of particles / Emmi Laukkanen, Mari Kauhaniemi, Timo Rasila / FMI

16:00 A visit to the FMI laboratories

17:00 Discussions at Dinner at FMI (5th floor)

Agenda – Wednesday 30th Jan

9:00 Road weather

- Road weather model – Virve Karsisto / FMI
- Road weather as a service – Ida-Reetta Virranjoki / FMI
- Road Weather in Russia
- Road Weather observations and modelling in Russia - Institute of Radar Meteorology

10:00 *Coffee break*

10:30 Air Quality monitoring

- Air quality measurements with LIDAR / SP University
- Air quality sensors / Antti Wemberg / FMI

12:00 *Lunch*

12:30 Discussions

13:30 End of Day 2

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Methodology for road traffic emission calculations in Finland

Emission factors from EEA meet Finnish road traffic distribution (VTT, LIPASTO)

18.2.2019 **Emmi Laukkanen**

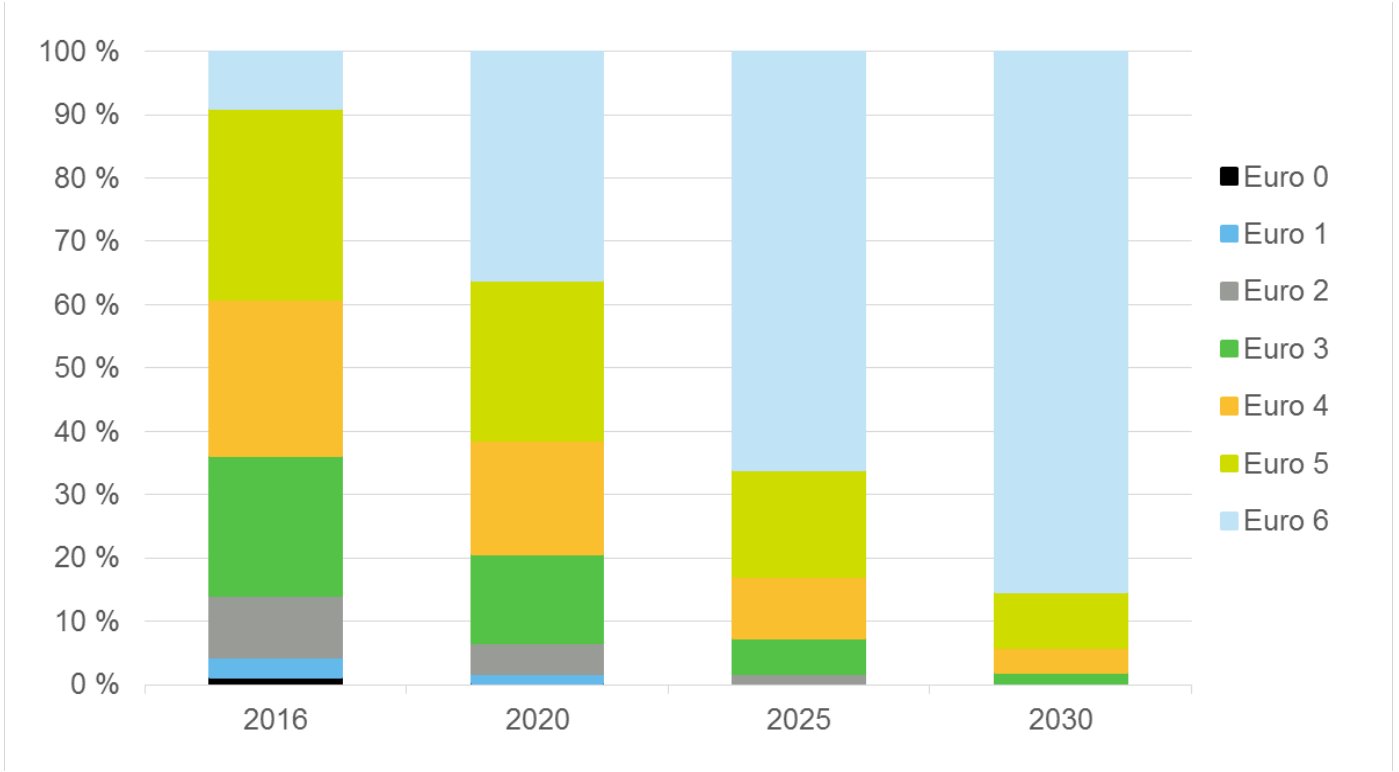
Car fleet composition in Finland

LIPASTO

- a calculation system for traffic exhaust emissions and energy use in Finland.
- The system is developed and published for public by **VTT Technical Research Centre of Finland Ltd**

ALIISA (submodel for LIPASTO)

- Car fleet composition model includes all vehicles (road traffic;
  - Vehicle type (Passanger cars, Bus, heavy duty trucks,..)
  - Technology (Bensin, Diesel, Electric, gas..)
  - EURO-Class
- How much each type of vehicle type (in each EURO-class, technology, vehicle type) performs (n shares %)



Also a forecast how the car fleet will develope in future..

http://lipasto.vtt.fi/index.htm

Emission factors

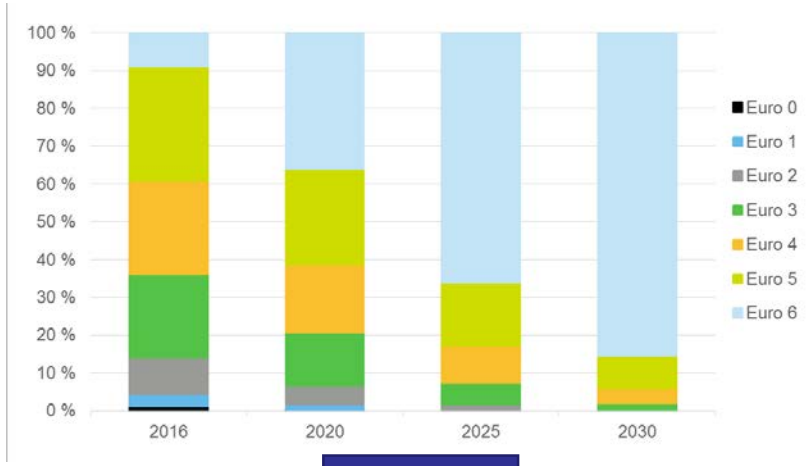
”TIER 3 method” (in *EEA, 2017.* Exhaust emissions from road transport. In EMEP/EEA air pollutant emission inventory guide book 2016, last update June 2017. EEA Report No 21/2016. European Environment Agency, Denmark. ISBN 978-92-9213-806-6)

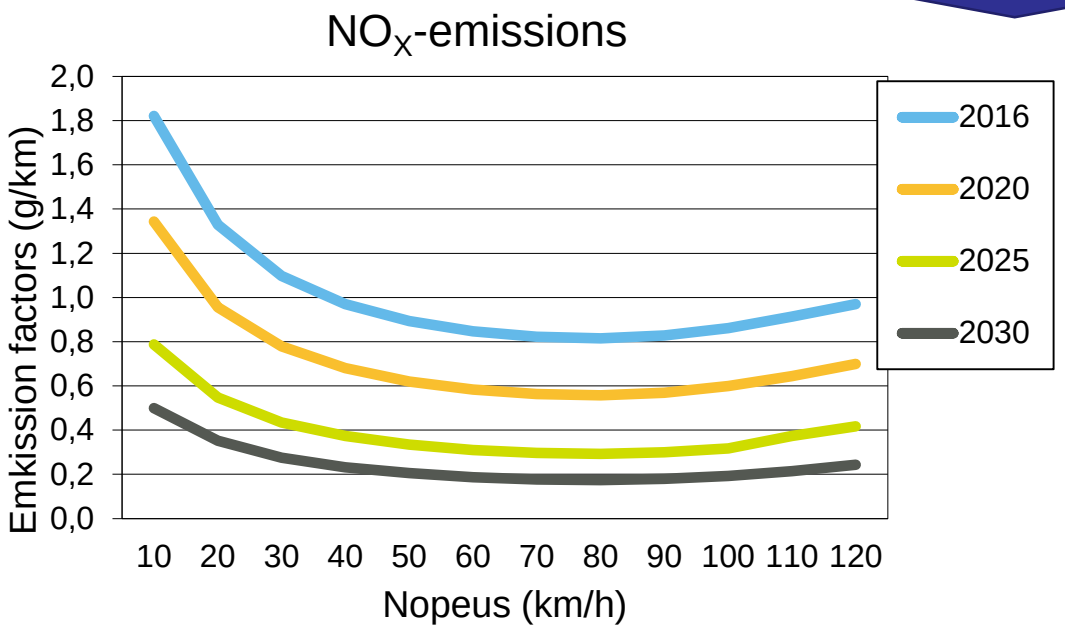
Emission factors
- for each type of vehicle
- for each EURO-class,
- dependent on driving velocity.

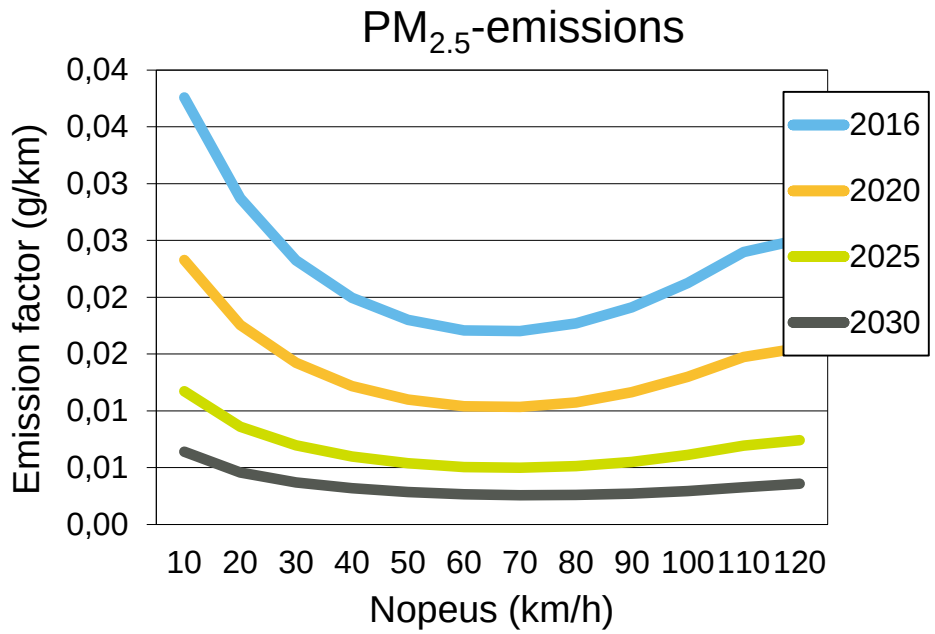
LRTAP Long-range Transboundary Air Pollution

European Environment Agency

Category		Title
NFR	1.A.3.b.i	Passenger cars
	1.A.3.b.ii	Light commercial trucks
	1.A.3.b.iii	Heavy-duty vehicles including buses
	1.A.3.b.iv	Motorcycles
SNAP	0701	Passenger cars
	0702	Light commercial vehicles < 3.5 t
	0703	Heavy-duty vehicles > 3.5 t and buses
	0704	Mopeds and motorcycles < 50 cm^3
	0705	Motorcycles > 50 cm^3
ISIC		
Version	Guidebook 2016	
Update	June 2017	







Car Fleet (VTT, 2018) + Emission coeffcients (EEA, 2017)
= Emission factors that depend on velocity and on car fleet

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Dispersion model CAR-FMI

18.2.2019 **Nimi**

Emission dispersion modelling

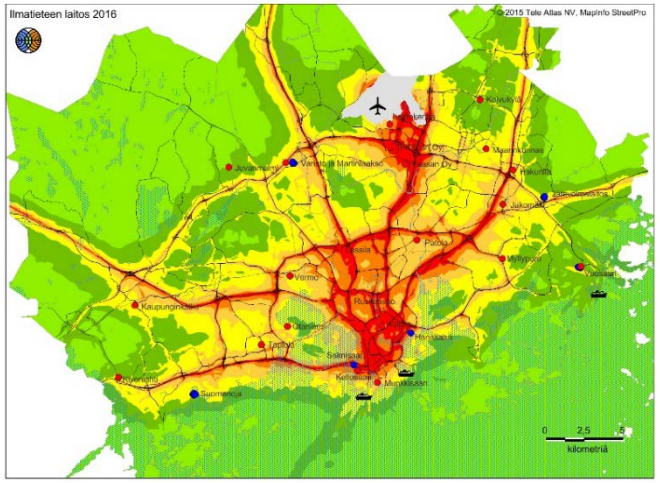
Emissions

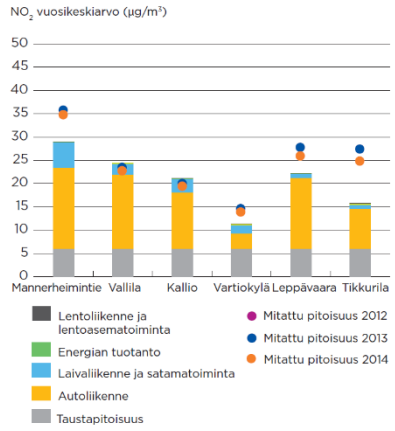
NO_x, SO_2, PM_{10}, $PM_{2,5}$, PAH, VOC, metallit...

Dispersion model

The model inculudes for example the chemical transformation, deposition, effects of the terrain, …

Model results: Distribution of the Concentrations in map





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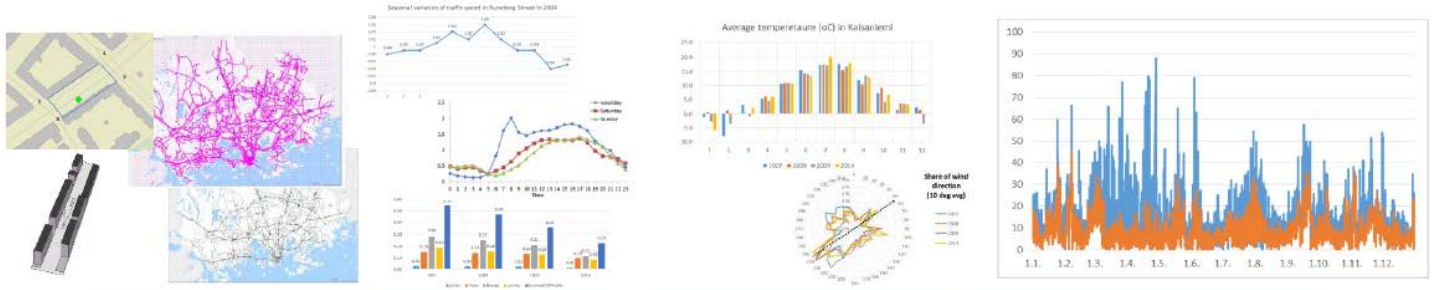
Line source dispersion modelling



Geographical data

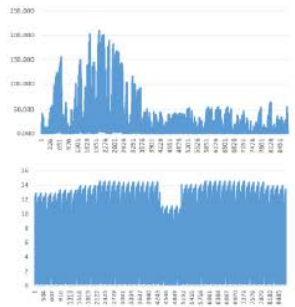
Traffic data

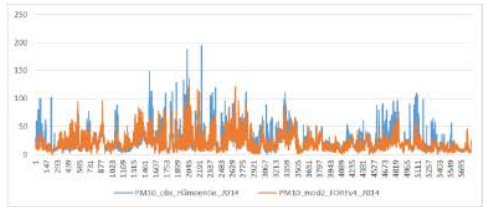
Meteorological data

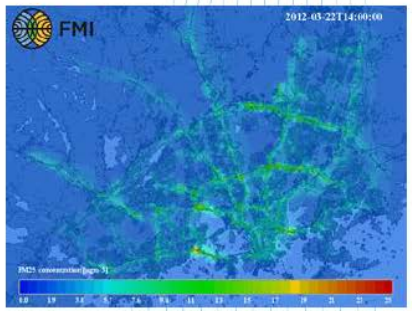
Background concentrations

Emission modelling

Dispersion model



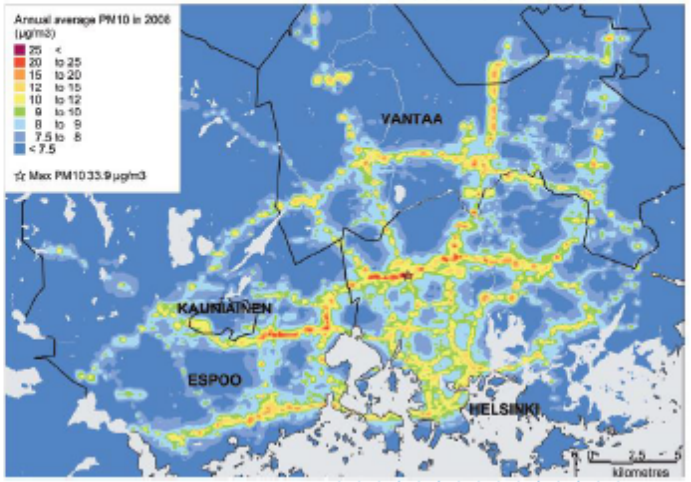




28/08/2018

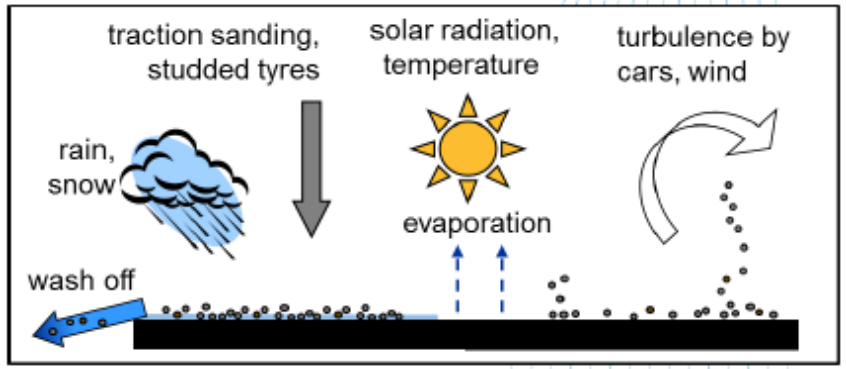
Open road network dispersion model (CAR-FMI)

- Contaminants in the Air from a Road (e.g., Härkönen, 2002)
- Traffic-originated pollution from an open road network, road is treated as a straight line of finite length
- Gaussian plume dispersion
  - with NO_x-O_3-NO_2 chemistry or
  - as inert tracer (or with dry deposition)
- Influence of terrain: average surface roughness, i.e. individual obstacles not included.
- Input
  - Receptor point and line source coordinates
  - Meteorological data
  - Background concentrations
  - Road traffic emissions
- Time resolution: hourly time series
- Spatial resolution not fixed:
  - User can define the set of receptor points
  - Generally from 20 to 500 meters



Road dust emission model (FORE)

- Forecasting Of Road dust Emissions (Kauhaniemi et al., 2011)
- Based on PM emission model of SMHI (Omstedt et al., 2005)
- Considers
  - Moisture content of the road surface.
  - Particles from the wear of pavement due to studded tyres and traction sand.
- Not considered
  - Emissions from the wear of vehicle components.
  - Dependencies of emissions on vehicle speed or fleet composition.
  - Influence of salting, dust binding, and cleaning.
- Input
  - Hourly meteorological time series
  - Share of studded tyres
  - Measured or modelled sanding dates
  - Reference emission factors



The main sources and formation processes of PM.

Input data needed to model the emissions from the road traffic:

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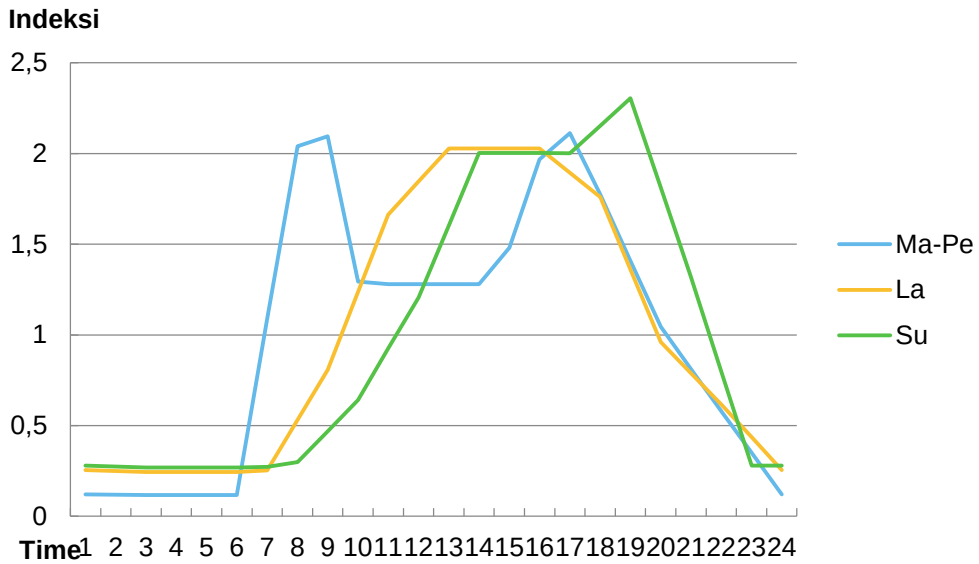
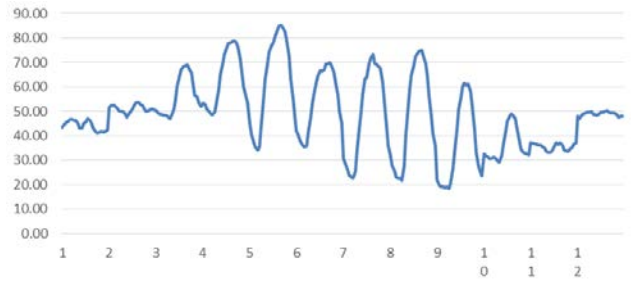
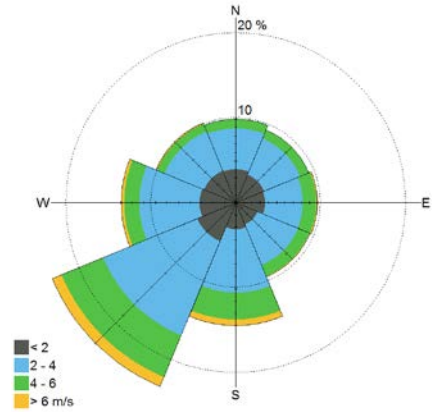
- **Information on the traffic**:
  - Traffic volume
  - Travel speed
  - Car fleet composition
    - Percentage of busses, vans, trucks, passanger cars, etc..
    - If you know the EURO classes of each vehicle type and how much you drive with each EURO-class, the information can be applied – how ever EEA has also TIER 1 and TIER 2 methods, that can be applied with less information.
  - Time variation of the traffic



- Background Hourly concentrations of ozone (O_3), nitrogen oxides (NO_x), small particles ($PM_{2.5}$)



- Meteorological data of years 2016-2018?



Questions & Notes

- Which year do we choose for the scenarios?
  - https://www.lvm.fi/-/liikenteen-paastot-nollaan-vuoteen-2045-mennessa-990321

- One very interesting point will be to compare the different types of calculation methods (Russia/Finland) and learn from them. -> **comparison to measurements is important**

- Which components we would like to investigate in this project? (Nox, PM2.5, (PM10?))