

# MODELLING OF EMISSION IN A ROADSIDE ENVIRONMENT CONFIGURATION

*Mia Pohjola<sup>1</sup>, Liisa Pirjola<sup>2,3</sup>,  
Jari Härkönen<sup>1</sup>*

<sup>1</sup>Finnish Meteorological Institute, Air Quality Research

<sup>3</sup>University of Helsinki, Department of Physical Sciences

<sup>2</sup>Helsinki Polytechnic, Dept. of Technology



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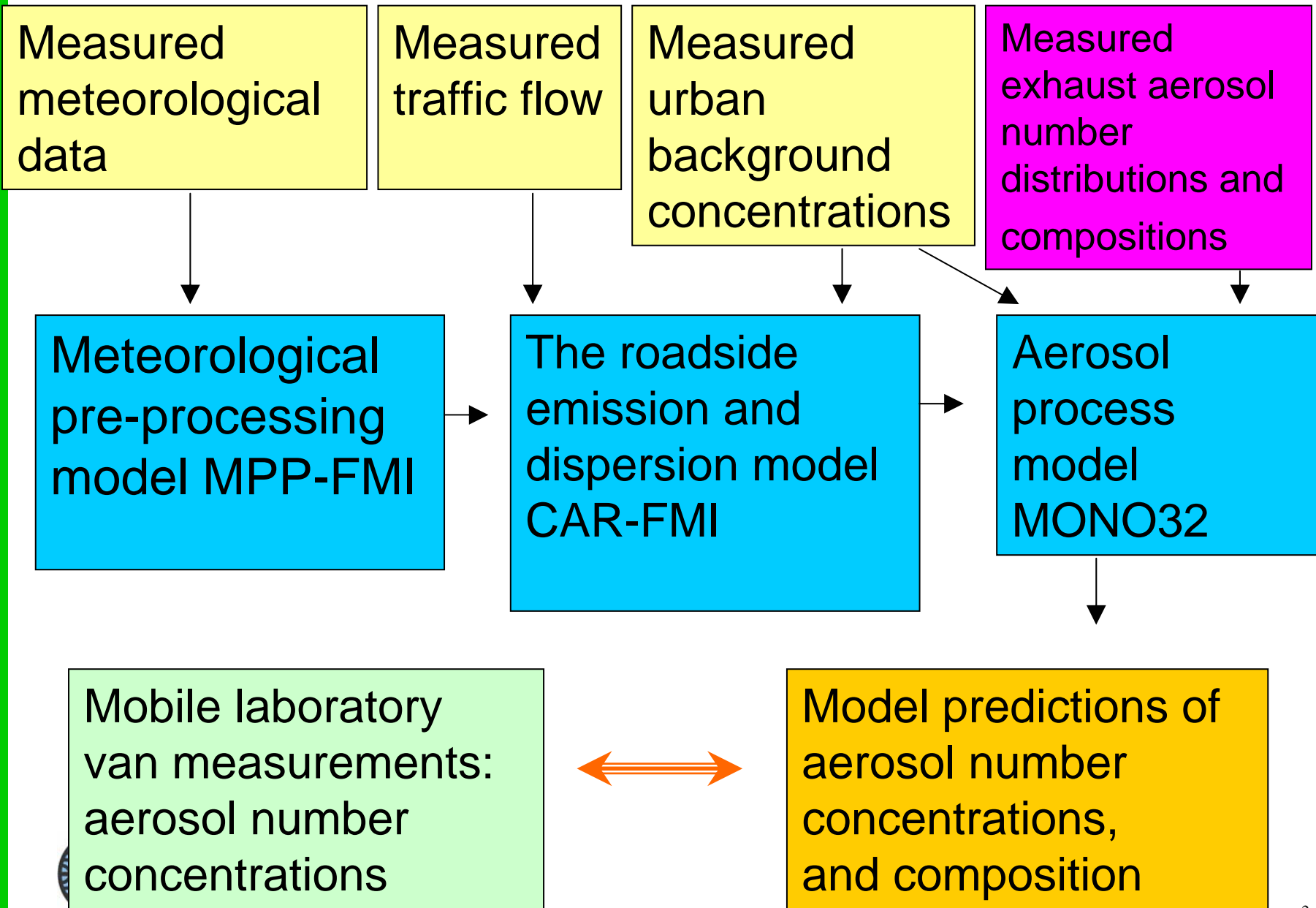


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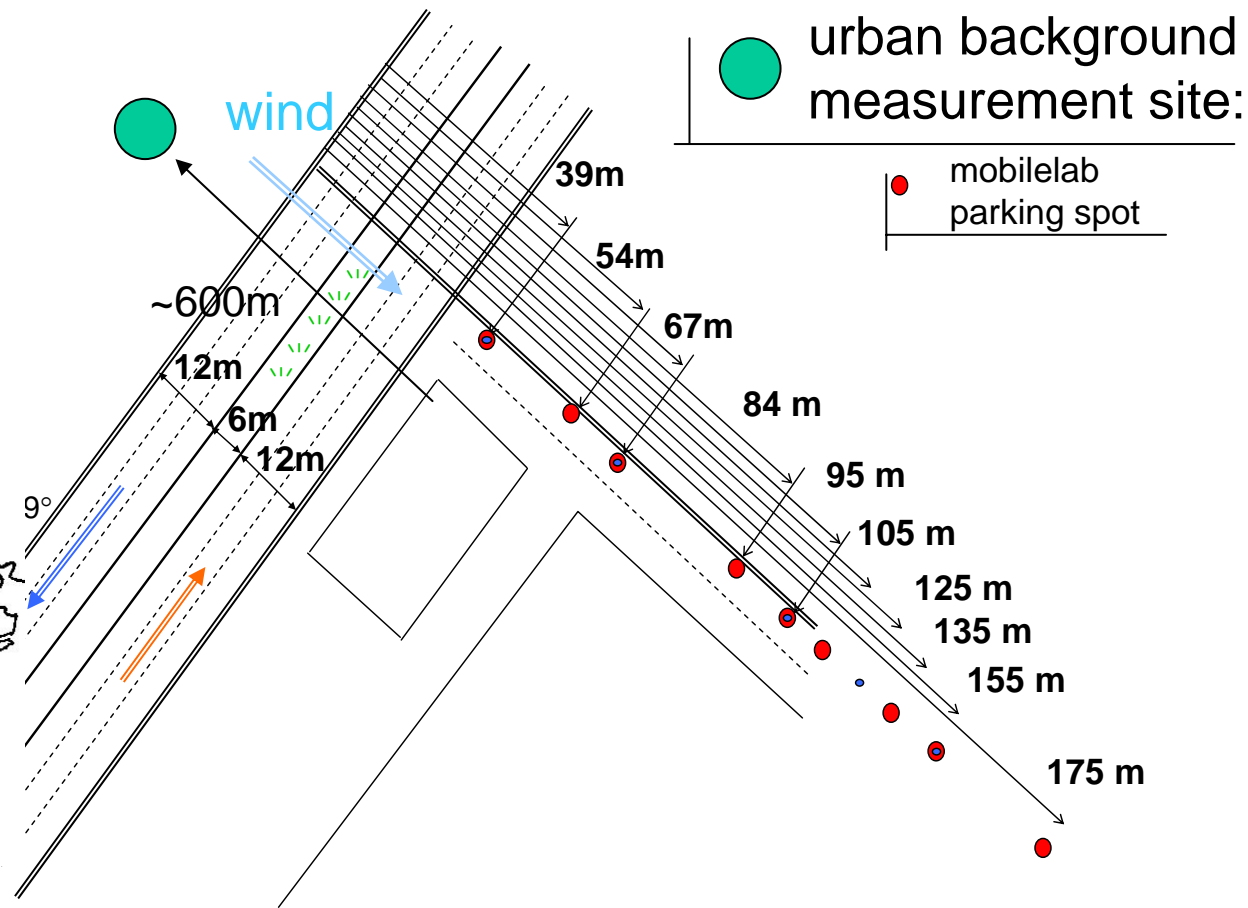


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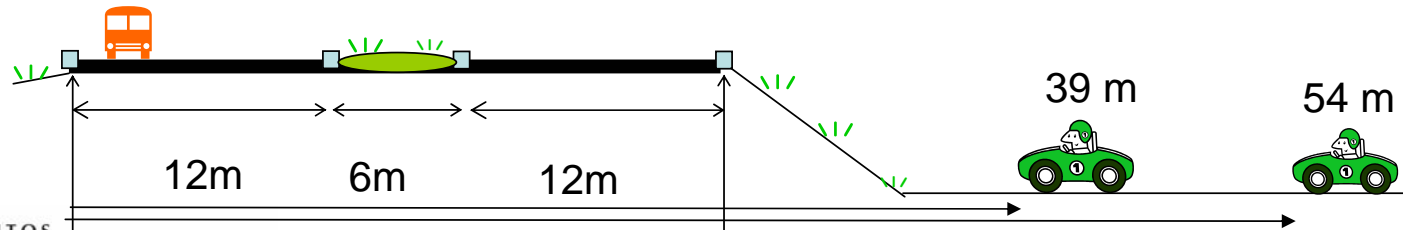
# The approach in our ongoing work



# The site



wind →



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# Description of the vehicle emission: Size number distribution

• **MONO**disperse representation for particle size distribution: mode limits chosen according to measurement data

- 1<sup>st</sup> nucleation mode             $1 \text{ nm} < d < 7.5 \text{ nm}$
- 2<sup>nd</sup> nucleation mode             $7.5 \text{ nm} < d < 43 \text{ nm}$
- Aitken mode                       $43 \text{ nm} < d < 122 \text{ nm}$
- 1<sup>st</sup> accumulation mode         $122 \text{ nm} < d < 321 \text{ nm}$
- 2<sup>nd</sup> accumulation mode         $321 \text{ nm} < d < 2.5 \text{ }\mu\text{m}$
- coarse mode                       $d > 2.5 \text{ }\mu\text{m}$



# Description of the vehicle emission: Size number distribution from measurements Size composition distribution from literature

- All particles in a mode have the same composition (internally mixed particles)
- 7 variables for mass concentrations per mode:

mode	Ø , nm	N (cm-3)	% of Ntot	m% H2SO4	m% OC	m% EC	m% sea salt	m% miner. dust	m% amm su	m% amm nit
nuc1	4,7	1,81e4	9,5	5	90	5	0	0	0	0
nuc2	9	1,53e5	80,7	5	90	5	0	0	0	0
Ait	36,4	1,65e4	8,7	0	26,8	63,5	0	7,2	0,3	2,2
acc1	102,5	1,97e3	1	0	25,5	62,5	0	8,8	0,3	2,8
acc2	225,5	6,46e1	0,3	0	25,5	62,5	0	8,8	0,3	2,8

# Description of the vehicle emission: Size composition distribution from compiled from a variety of literature

“Recent findings suggest that the volatile component of diesel particles to 95% consists of unburned lubrication oil.” in:

**Sakurai, Tobias, Park, Zarling, Docherty, Kittelson, McMurray, Ziemann, 2003.** On-line measurements of diesel nanoparticle composition and volatility. Atmospheric Environment 37, 1199-1210.

**Norbeck, Durbin, Truex: 1998:**

Measurement of Primary Particulate Matter Emissions from Light –Duty Motor Vehicles. Center for Environmental Research and Technology College of Engineering Report. 57 pp.

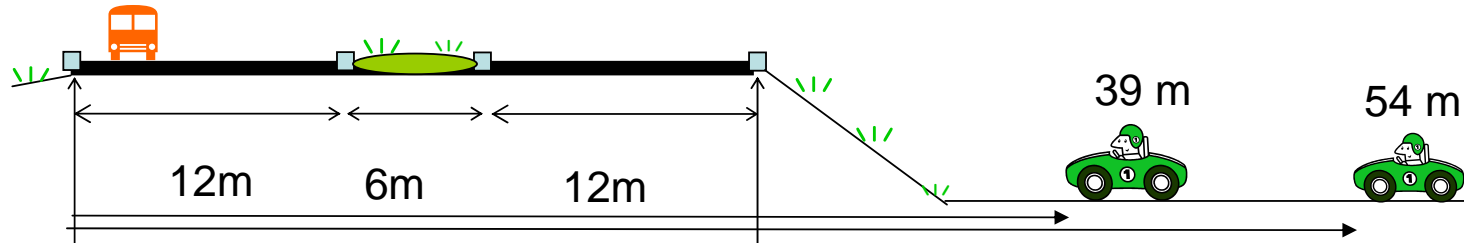
Characterizing Particulate Emissions from Medium- and Light Heavy Duty Diesel-Fueled Vehicles. Center for Environmental Research and Technology College of Engineering Report. 25 pp.

**Shi, Mark, Harrison, 2000.** Characterization of Particles from a Current Technology Heavy-Duty Diesel Engine. Environ. Sci. Tech, 748-755.

**Kauhaniemi Mari, 2003.** Usability of the Air Quality Model CAR-FMI in City Planning. Master’s Thesis, University of Oulu, Department of Process and Environmental Engineering, Control Engineering Laboratory, 87+7 (13) p.



# Description of dilution from CAR-FMI



## In MONO32:

- Emission for 12m, traffic induced turbulence not included, only accumulation of emitted particles according to wind speed
- then 6 m of dilution only (CAR) with background air
- then 12 m of emission, traffic induced turbulence not included, only accumulation of emitted particles according to wind speed
- followed by dilution (CAR) again with background air

# The measurement campaign 2/2

- Particle size distribution measurement at a height of 2.4 m:
  - Electrical Low Pressure Impactor: 7 nm – 10  $\mu\text{m}$  (12 channels) (aerodynamic diameter)
  - Scanning Mobility Particle Sizer: 3 – 50 nm (mobility diameter)
  - Condensation Particle Counter:  
total number concentration of particles  
larger than 3 nm
- Meteorological measurements at a height of 10 m (cabin roof):
  - Relative wind speed & direction
  - Temperature, relative humidity
- Global Positioning System:
  - Van speed, driving route

