Joint analysis of meteorology and air quality in Helsinki, using air-quality supersites and an observation network

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* John is the main post-doc working on this project
FMI

- 600-700 personnel
- About ½ research, ½ operations
- Research includes met, AQ, space, oceans, etc
- Also consultancy services: e.g. Helsinki Region Environmental Services Authority and FMI jointly evaluate impacts of various scenarios of urban development
CAR-FMI (see also AQFS)

Real-time results shown on website uaqfs.fmi.fi

• We treat it as a ‘black box’ AQ model in this talk

• It is a simple tool based on dispersion from line sources (roads)

• PM2.5, CO, NO, NO2, NOx, O3

• It relies on 1-hr meteorological data (e.g. MPP) and traffic counts

• It is normally run for a year or two for consultancy projects – such as city planning


MPP (meteorological pre-processor)

• Based on MOST/empirical relationships

• It estimates fluxes and ABL depth from simple variables (T, U, etc)

• Different local(FMI) versions exist! – we deal with one here


Helsinki latest papers (2015)

Nordbo A, Karsisto P, Matikainen L, Wood CR, Järvi L
Urban surface cover determined with airborne lidar -- implications to surface energy balance modelling.
Urban Climate

Footprint Evaluation for Flux and Concentration Measurements for an Urban-Like Canopy with Coupled Lagrangian Stochastic and Large-Eddy Simulation Models.
BLMet

LES for downtown Helsinki – further work underway.

http://urban.fmi.fi
ONE RESEARCH ITEM

Weather models (MPP)

Weather observations (Helsinki UrBAN)

AQ models (CAR FMI)

AQ observations
Part of 1 work package: MPP and obs comparison

Observations from Kumpula (semi-urban)
1.1.2011 – 31.8.2013 (80-90% coverage)
|Q_E| over estimated in MPP
Q_H underestimated in MPP
$u^*$ underestimated in MPP

$\Rightarrow$ Need to check $z_0$ in MPP
z/L over estimated in MPP

\[ \text{EC derived} \]

-\[ \text{Largely due to } u^3 \]
Open Questions

Weather models (MPP)

Weather observations (Helsinki UrBAN)

AQ models (CAR FMI)

- Are the errors a general MPP problem? (1) Bowen, (2) z0
- Is this site specific?
- How important is this for the output FMI air-quality models such as CAR-FMI?
- Is it worth replacing those MPP data with flux observations directly or with NWP fluxes?