Micrometeorological studies at SMEAR III station in Kumpula, Helsinki.

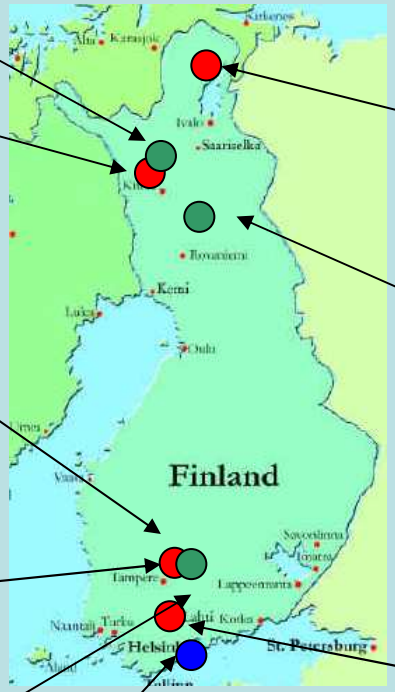
T. Vesala, L. Järvi, S. Launiainen, A.Sogachev, Ü. Rannik, I. Mammarella, E. Siivola, P. Keronen and J. Rinne

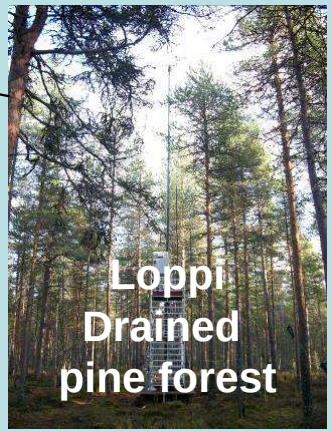
Department of Physics, Univ. Helsinki

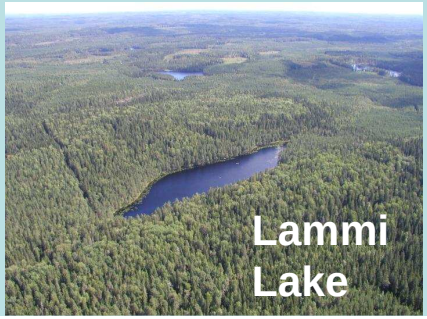

SMEAR I
SMEAR II
SMEAR III
Murmansk
Inari
Kemi
Kalixälven
Ponoy
Archangelsk
Oulu
Iijoki
Indalsälven
Gävle
Ångermanälven
FINLAND
Ljusnan
Tampere
Oslo
Dalälven
Turku
Helsinki
St Petersburg
Tallinn
Onega Lake
Ladoga Lake
Ozero Beloye
Rybinskoye
Vänern
Vättern
Åtran
BALTIC SEA
ESTONIA
Emån

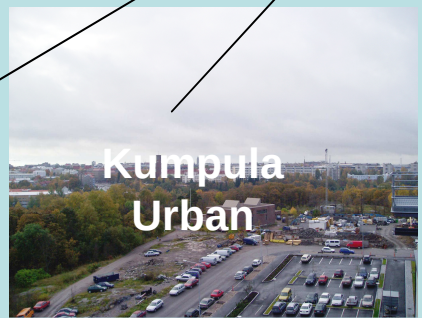
Current flux sites

- Peat soil
- Mineral soil
- Urban environment









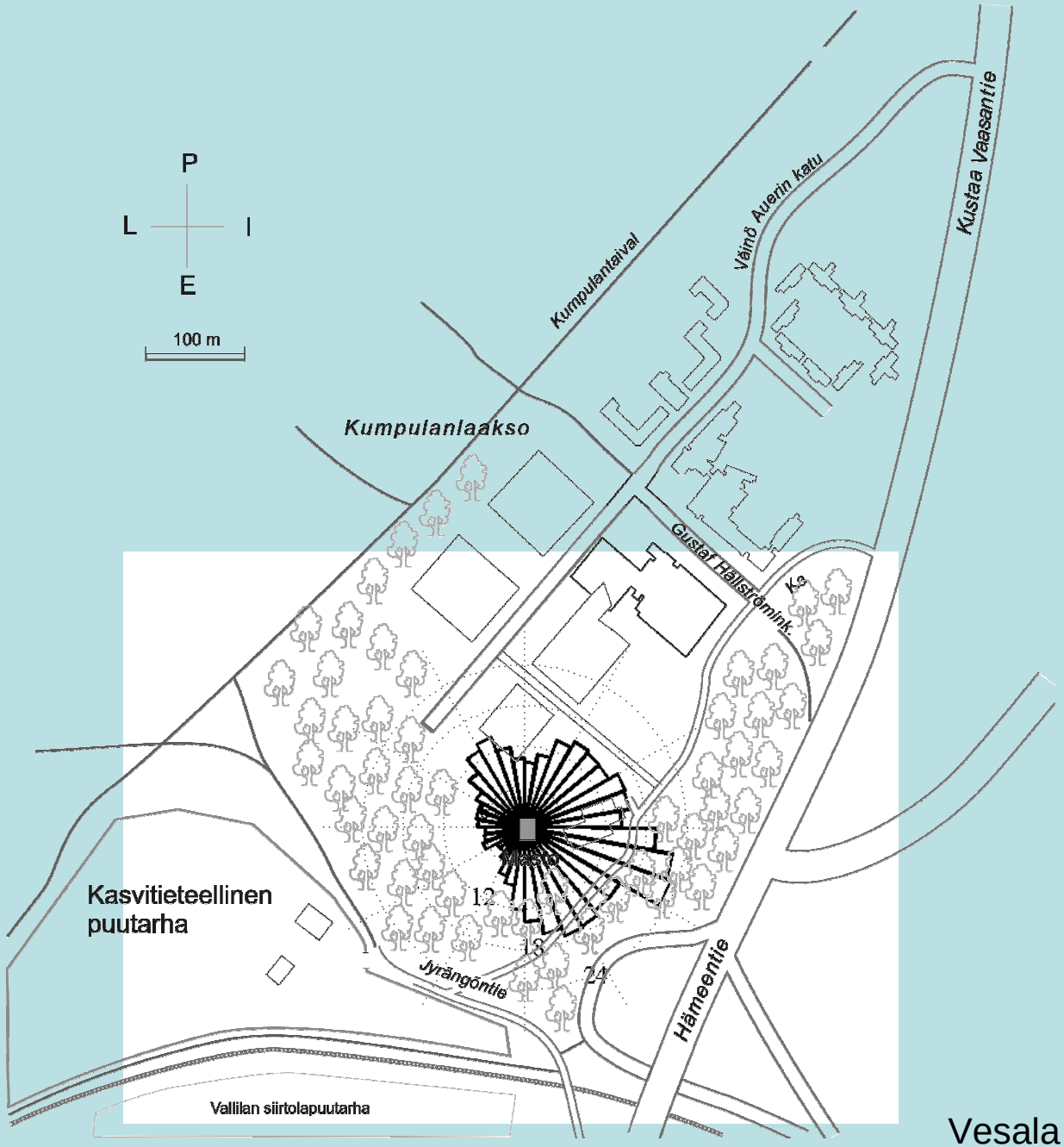
The SMEAR III station

- 31 m high tower is the part of SMEAR III

- turbulent fluxes of momentum, sensible and latent heat, CO2 and aerosol particle number are measured

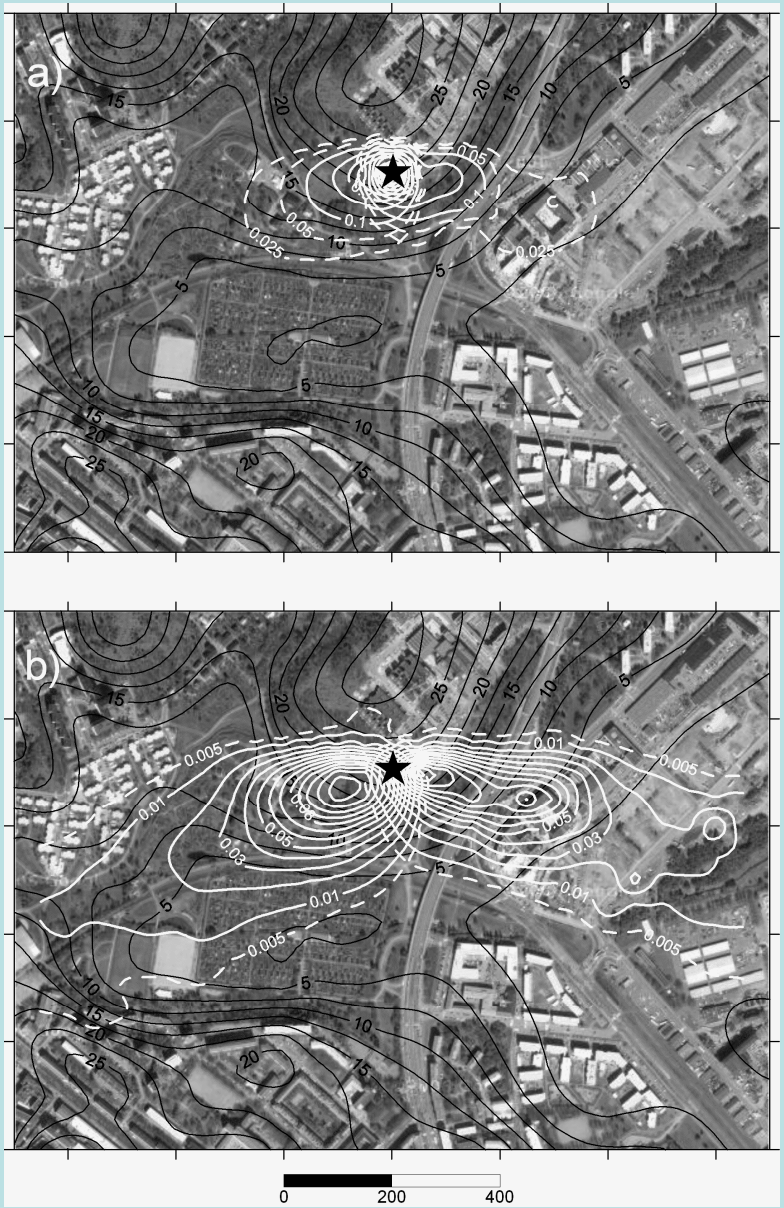
The measurement system of turbulent fluxes

- Turbulent fluxes are calculated with eddy-covariance (EC) technique
- The measurement set-up includes:
  - A 3-D ultrasonic anemometer (Metek USA-1) to measure vertical wind speed
  - Open-path (LI-7500) and closed-path gas analyzers (LI-7000) to measure CO_2 and H_2O concentrations
  - Condensation particle counter (CPC-3781) measures the total aerosol particle concentration



Vesala et al. (2007)

Source areas (footprints)



- Atmospheric boundary layer model SCADIS (Sogachev et al. 2004)

- Footprint estimates for canopy and ground sources/sinks separately

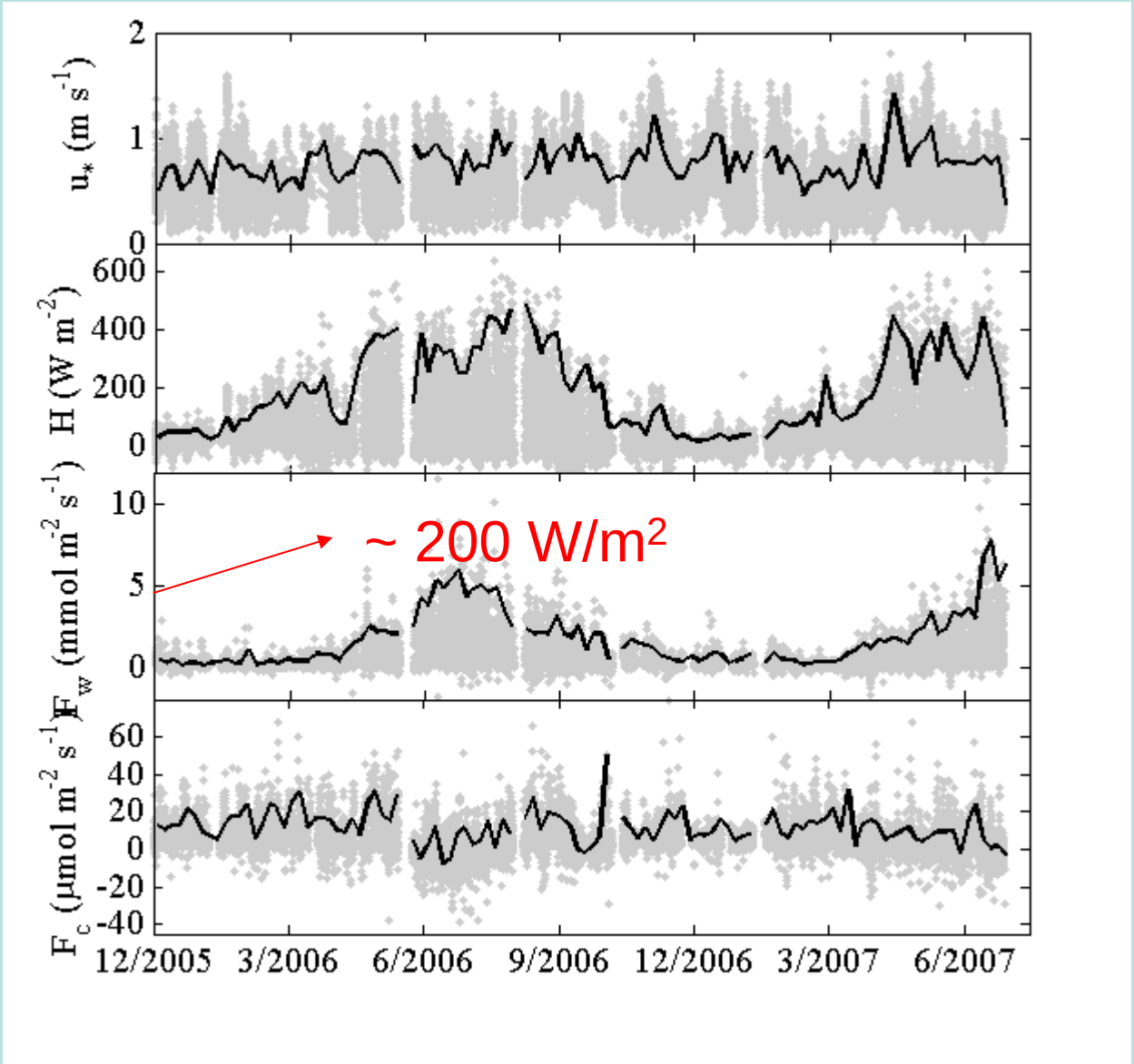
Flux time series

Friction velocity

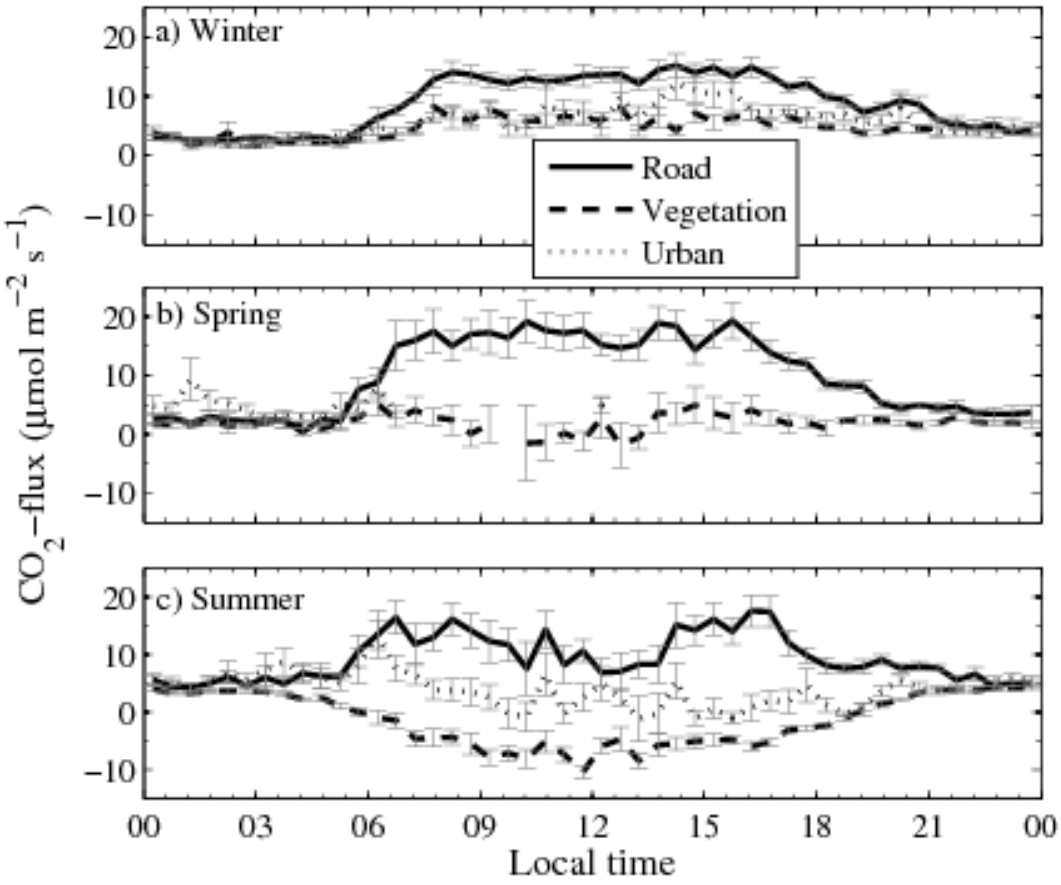
Sensible heat

Water vapour

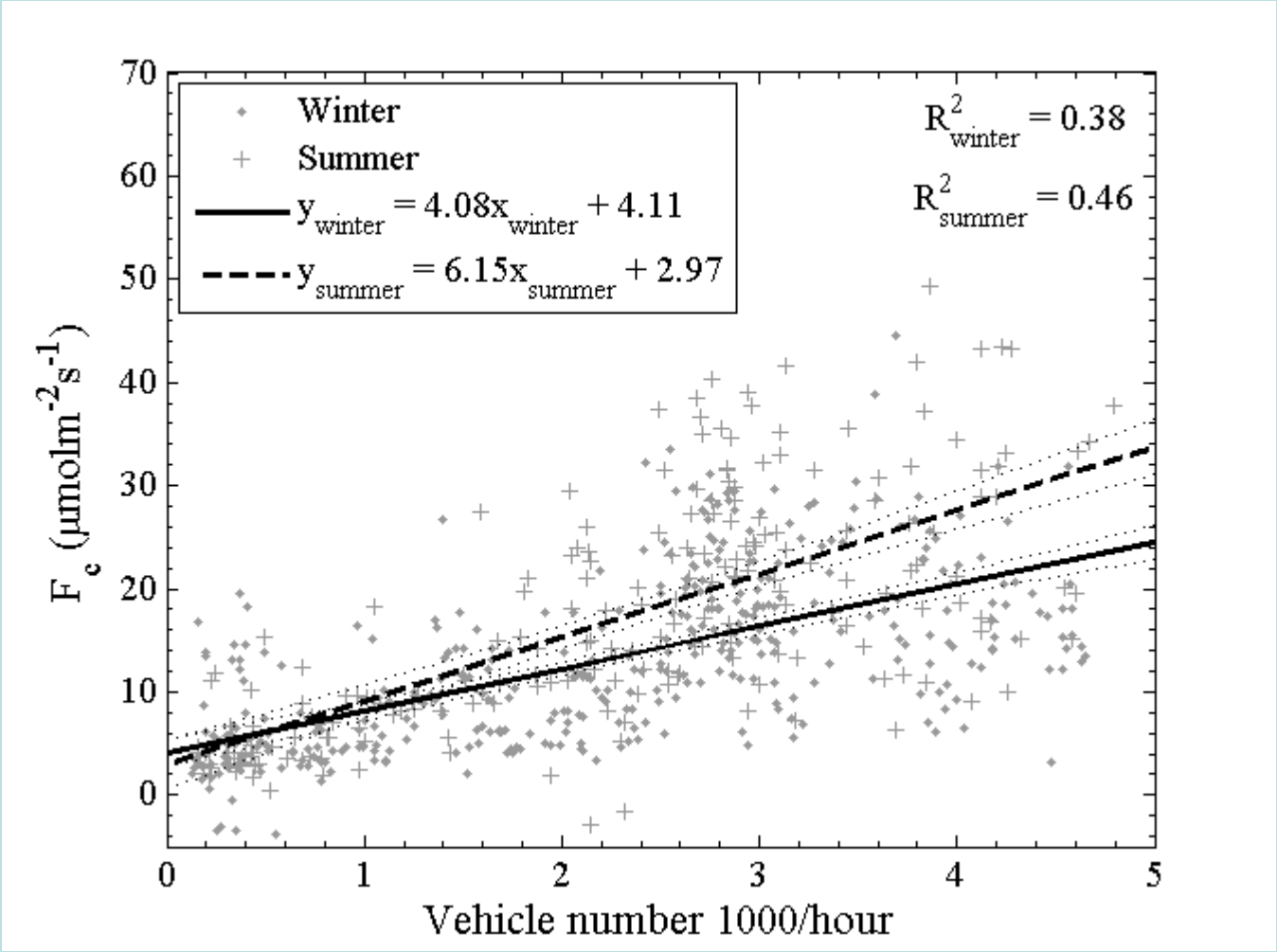
CO2



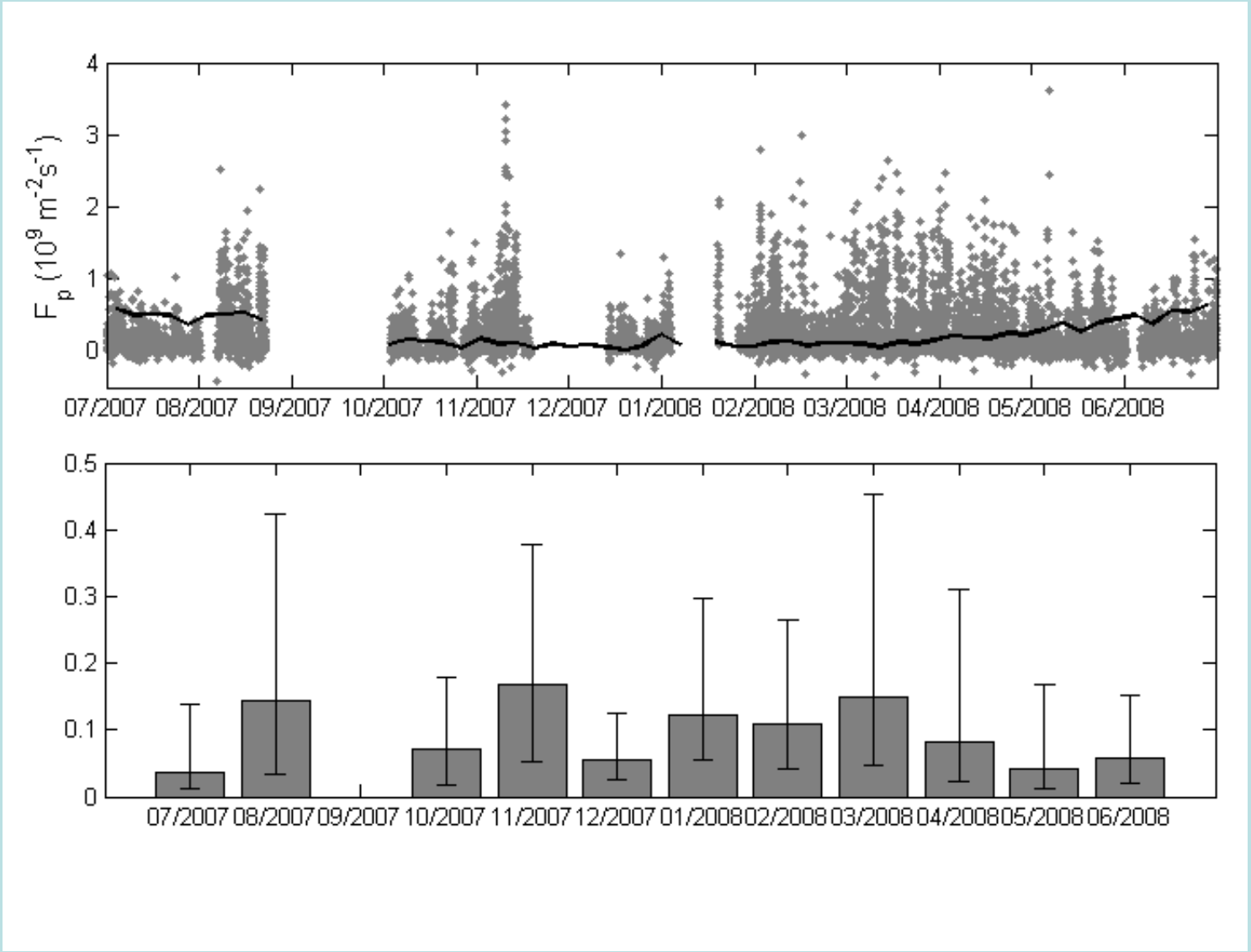
CO2 flux vs. season vs. land-use sector



CO2 flux vs. traffic rate

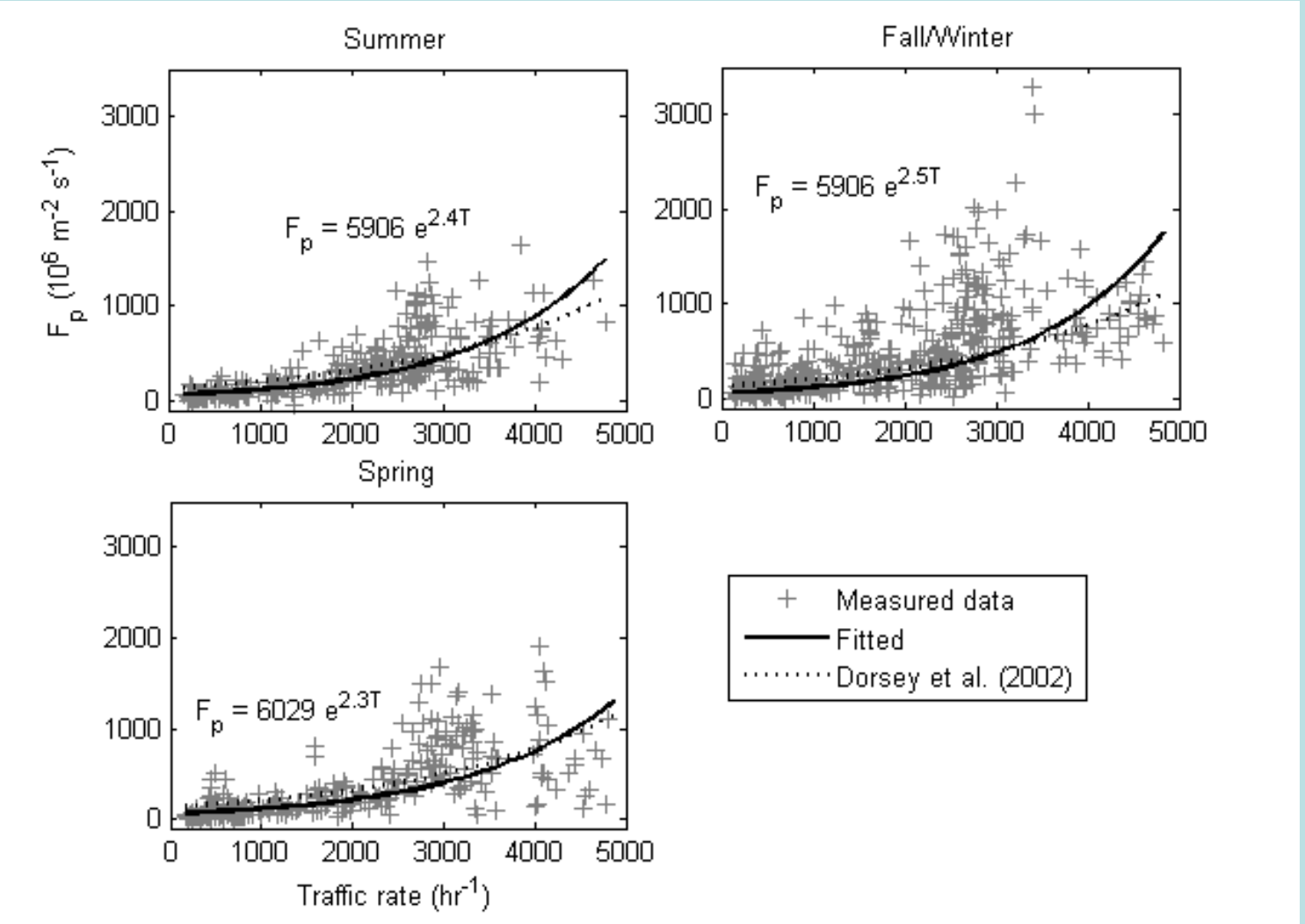


Aerosol particle number flux series



L. Järvi

Aerosol particle flux vs. season vs. traffic rate



CONCLUSIONS

- Flux studies over urban are scarce
- SMEAR III is the northernmost and seasonality is pronounced
- Land-use cover and traffic rate dependence
- CO_2 resembles Copenhagen, Edinburgh, Marseille (<) and Basel, Chicago and Tokyo (>)
- Utilization of very versatile SMEAR III measurement scheme

Vesala T. et al., Surface-atmosphere interactions over Complex urban terrain in Helsinki, Finland. **Tellus 60B, 188, (2008).**

Järvi L., Alustan rosoisuus ja turbulenssin ominaisuudet Kaupunkiympäristössä. **Pro gradu –työ, Fysiikan laitos, Helsingin yliopisto (2005).**